

MANUAL FOR  
THE MOTOR  
SUPPLY TRAIN  
U. S. ARMY  
ITS ORGANIZATION  
AND WORK  
1918



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**MANUAL**  
**FOR**  
**THE MOTOR SUPPLY TRAIN**  
**U.S. ARMY**

*(Its organization and work)*

A compilation from various  
service manuals and from  
other official and semi-  
official sources

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## PREFACE

The first purpose of this book is to furnish National Army Supply Train Officers, now in the process of organizing Divisional Supply Trains, or who will be detailed for such a duty in the future, with complete information for their use in the organization, administration, training, and operation of their companies. It represents a compilation of all available data on the subject, and finds its basis in "Manual for Motor Transportation" compiled by Lt. Colonel Ralph Talbot, Jr. (Cavalry), Q. M. Corps, which in turn was based upon "Notes on the Organization and Operation of a Motor Truck Company" dictated by Colonel Francis H. Pope (Cavalry), Q. M. Corps, from his experiences during and subsequent to the Punitive Expedition into Mexico. This information is in as well organized and as well balanced a form as possible, though not wholly applicable to our special mission in France. With its complete detail as to the duties of all members of motor truck companies, as to the operation of motor trucks, and as to truck equipment, truck mechanism and the cause and remedy of truck troubles, it is designed to be of use to every truckmaster and chauffeur. As in the motor transport service each man is so largely a separate unit, he must be a man of intelligence and have a clear understanding of the make-up and operation of his organization.



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## INTRODUCTION

The following notes on the conditions of Military roads on the Western front will give an idea of the setting for the work of each Supply Train and motor transportation unit, which will be sent with the American forces to France:

When a division moves to a new point, different units of the division may be ordered to move on different routes. Marching troops are slow moving and tend to obstruct motor traffic on the main roads; side roads are better suited for them. Light motor ambulances can take a longer route using secondary roads. Horse-drawn supply wagons can take rough side roads which have been allowed to get in bad condition. Heavy motor trucks, with low gasoline mileage and costly to repair, must have the best roads and the direct route. In such movements, each unit is given its routing; it may or may not be designed to prevent congestion accordingly as the necessity exists. But the general scheme is there ready for use and it is made possible by the minute network of roads of all classes in the French system.

All cross roads and road junctions are plainly and permanently marked with distances and directions to neighboring points. This has proved an invaluable aid to effective movements of units in charge of officers, the great majority of whom are strangers in the particular locality. It is impossible to conceive of all the divergent movements of the present war being put through without the aid of these road signs, except with endless confusion and delay. On the other hand, they must be of similar aid to the enemy in the occupied territory. It would be an excellent plan in any retreat, or in time of invasion, to have men especially detailed to destroy all road signs before the retirement.

The road leading from Amiens to the front lines of the Peronne-Chaulnes sector, is a good example of extreme concentration of traffic on a main feeder of a busy front. From Proyart to the front,—a distance of about nine miles,—the bulk of the traffic must move at night, incidentally without lights, to avoid observation by the enemy. From Amiens to Proyart, it moves principally in the day time. In both instances it is practically continuous,—four solid lines of vehicles move in almost continuous procession. Slow moving horse-drawn vehicles hug the shoulders of the roadway, leaving the center for motor travel. Fleets of motor trucks pound steadily by, in hundreds; spaced only about fifty feet apart, and traveling at an average rate of at least 12 miles per hour.

All convoys, or fleets of vehicles, move in a formation which provides an open space of 100 to 200 feet or more after a group of several vehicles. Certain vehicles in the convoy carry a large red disk about a foot in diameter to indicate to the driver following that he is to leave space. This is to expedite the passage of fast moving units such as officers' cars, despatch cars, or

ambulances, which would otherwise be forced to proceed at the speed of the convoy. Even with four lines moving, an open space several feet in width is usually maintained in the center. Independent units move in this, dropping into convoy spaces to permit the passage of other independents going in the opposite direction.

The worst roads are encountered very near the front, in an active sector. The artillery fire of the enemy say, within five kilometers of the front line is very destructive to the roads and in a great measure, prevents effective repair work. This is particularly true in the Somme sector, where the country is flat and practically treeless, and so without protection to the roads or the traffic moving on them. Most of the time, the enemy fire is directed on the roads and batteries in the zone from two kilometers to four kilometers back of the line.

Here too, the entire area was swept with creeping barrage fire during the Allied offensive and advance. Roads were destroyed and there has been no opportunity to rebuild them in good shape. It is a fact therefore that even the main road is in very rough condition after one advances beyond the position of the French first line trenches before the offensive,—that is, in recaptured territory. Ambulances, for instance, are obliged to run largely in low gear from this point to and from the advanced dressing stations. The roads are passable but extremely rough. In this sector, too, upkeep of roads within about two kilometers of the front line is not attempted. Their position is too exposed and the shelling too severe. No vehicles approach the front beyond this limit, except the small "soup kitchens" and light supply wagons, and these only at night.

The prevailing grades are very easy permitting heavy loads for horse-drawn vehicles and faster speeds for motor convoys. Location lines are found to follow contours in almost all cases. This has made for easier maintenance and easier rebuilding after destruction.

Width of traveling surface has been most important to army transport. Some of the grand highways, main feeders to the front, have a width of about thirty-three feet between shoulders. Even this is crowded to capacity most of the time. How great a factor these widths have been to the success of the French army, cannot be estimated nor can we guess the difference in offensive and defensive results, if they had been say, the 18-foot American standard.

The landscape is a veritable network of roads. The number of miles of road per square mile of territory must be at least double,—probably more,—than in the United States. Inasmuch as these are all improved roads this has been of great service to army movements. Between two given points, several routes may be selected, none of which will greatly exceed the most direct route in distance.



## CHAPTER I

### THE ARMY TRANSPORT SERVICE IN GENERAL

#### Part 1

#### A BROAD VIEW OF THE SUPPLY SERVICE ADAPTED TO THE WAR ZONE IN FRANCE

The first link in the chain of organization of the Supply Service in France is the base supply depot or station magazine, one of which exists for every army in France. Each one of our armies, then, will have such a depot somewhere in central France, which is fed from three different sources, (1) French ports of importation used by American forces, (2) Factories in southern France, and (3) Mediterranean ports. The supplies imported from America are immediately loaded in cars at the port of importation and sent to a base supply depot. In the French service, each depot is under the charge of the military member of the Station Commission, whose special function it is to supply from the depot the wants of the army in accordance with the demands which he receives. These demands he distributes among the different departments of the depot and states when the cars be loaded. He must not interfere with the internal administration of the station or with the technical direction and execution of the railway service. When supplies come to the depot, if they are wanted immediately they are sent forward at once, without unloading. Where single units need all supplies carried in any one car; if they are not wanted immediately, they are unloaded at the depot. As a general reserve, the Depot Quartermaster should have on hand at least eight days of reserve food.

The base supply depot is in the Zone of the Interior or the Rear. From there supplies go to the Regulating Stations, which are in the Zone of the Armies. The Regulation Station is under charge of a Regulating Commissioner who receives orders direct from the highest military authority only. This is the place of final regulation of supplies going to the front. The regulating commissioner alone knows exactly where the army units are and just where everything is wanted. There is a railroad yard at this station divided into receiving and forwarding sections, a yard sometimes as much as a mile long. The station must be able to supply the largest number of men which can be gotten into the army sector which it feeds. There is an officer in charge at the switch into the big yards, and when the trainloads come, he sees that they are divided up and routed to their proper division; each track in the yard corresponds to a divisional train. One of these yards was built inside of a month in the Verdun sector, and communication not interfered with in the meanwhile. Near the regulating station there must be stored 2 days of reserve

supplies for the sector, one on an emergency train and one in storehouses. The large army bakeries are established at the regulating stations. There also is located a huge depot of ammunition, made up of many small stations so that if one is destroyed by shelling the whole thing won't go. The stations are designed to be out of shelling distance.

Beyond the regulating station, at not more than 12 hours distance by railroad, the next important point is the rail-head. It is the farthest point where normal gauge railways can go; from there supplies are carried up mainly by narrow-gauge railways. Each regiment has a 60-cm. gauge railway running to it. At the railhead, trains are met by the division quartermaster, and divided up between the units of his division. There is a storehouse at the railhead to keep surplus supplies, and there must be always one day's reserve food on hand. There also are depots for ammunition of every calibre. The railheads supply both divisions at the front and in reserve; for the divisions in reserve the Division Supply Trains come to the railheads and secure the supplies to transport on their trucks to the division's base. Toward the front, as has been said, supplies are transported on narrow-gauge railways; the 60-cm. road goes as far as possible toward the front; these railroads are under a director-general, and have a station master at each station. The trains must pass each station on schedule time. Beyond the limit of the 60-cm. gauge railways there are the 40-cm., which can run in the boyaux; in mountainous regions, where these can't be used, donkeys are employed; they are smaller than mules and are very valuable for going up boyaux for that reason. The last resort in the transportation of supplies is the shoulders of the men themselves.

Evacuations from the army of sick and wounded, prisoners, surplus stores, etc., are effected from railhead by means of the daily supply trains, returning thence to the advance depot, where the Regulating Commission takes them in charge and passes them on by the trains going back to the rear. At a central point in each railroad area there is a garage for ambulance trains.

It will have been seen that the service of motor truck transportation and therefore the Supply Train is not ordinarily used by the division when in the front lines; the ground beyond the railheads usually cannot be travelled by trucks because torn by shell-holes. But the service of motor trucks has been very distinct in the war, as they are used for divisions in reserve practically altogether, and they have performed conspicuous service in the replacement of railroads when needed in a pinch. In the Verdun sector they furnished all the transportation until the regulating station was completed after the big German attack of 1916 began; they furnished transportation for food, ammunition and men. The road from Bar-le-Duc to Verdun, over which they travelled is now known as the Sacred Way. The service they performed was perfect, and the regularity of supply which they gave the hard pressed Verdun Army was a great factor in the

splendid and successful French defense. The railroads had been cut off and they filled the gap. During the heaviest attacks there at a given point on the road one truck passed every 20 seconds.

## Part 2

### SUPPLY RAILWAYS

Supply railways include all railways, except combat railways, that may be constructed or used for the supply of an army in the field. They may vary from a light, portable track to a standard-gauge railway. Their *principal uses* will be to connect the army with its base; to connect permanent camps with the nearest existing railway; to form a belt line around a besieged place outside the field of observation; to form a belt line inside the line of defense of a besieged place; for the movable gun defense, and for a general supply line to supply an army in a permanent position such as the Russian army often occupied in Manchuria. In extreme cases a railway may have to be constructed to supply an advancing army when local conditions preclude other means of transportation.

For cruder forms on which animals are used as the motive power the description already given of a combat railway will suffice. They are what are known as *tramways*. As soon as some form of mechanical traction is to be provided for the line becomes a "*railway*" in the commonly accepted meaning of the word.

Regardless of the gauge, the same underlying principles govern the construction of all such lines, and, having a plan for the operation and maintenance of an existing line of railway, it is easy to adapt it to the requirements of a temporary line. The *principal considerations* that govern in planning for such a line are, first, the amount of army supplies, troops, and animals that must be handled; second, the time that can be permitted for its construction; and third, which applies particularly to operations beyond the sea, the amount of transportation necessary to place the railway supplies on the work. This third condition will ordinarily necessitate a narrow-gauge railway for a supply railway in a country beyond the sea. Local conditions, such as a great supply of standard-gauge material and rolling stock, may render advisable the building of a standard-gauge railway for operations from a friendly land base; but where conditions extremely favorable to a standard-gauge line do not exist, a narrow-gauge railway will probably be decided upon in the general case of supply railways. The weight of the materials and rolling stock is so much smaller, the bridges can be so much lighter, and the earth-work is so much less than for a standard-gauge road that the narrow-gauge railway is decidedly easier and quicker to build.

On the Barsi Railway, built in India, a 2 ft. 6 in. gauge was



used. The weight of the locomotive was 58,800 lbs. in working order; it had an eight-wheel base with a four-wheel pilot truck (bogie), 13 by 18 in. cylinders, and used a working steam pressure of 150 lbs. The rigid wheel base was 8 ft. 3 ins.; total wheel base, 18 ft. 6 ins. The weight on each of the six axles was 10,000 lbs. The sharpest curve on the line has a radius of 175 ft. On a level tangent this locomotive drew 1,036 tons at 15 miles an hour; and on a 1% grade,  $9\frac{1}{2}^\circ$  curve, it hauled 291 tons at 8 miles an hour.

They were able to run sixteen trains a day in each direction, which, excluding the weight of the cars, carried 3,360 tons each way daily. The load on each car axle was the same as on the locomotive axle—i. e., 5 tons. The weight of rail used was 35 lbs. per yard.

General Sherman's army at Atlanta was composed of 100,000 men and 35,000 animals, in a hostile country. The *net train supply* to him was 1,600 tons daily, which he said was in excess of the amount necessary to supply his army. A comparison of these figures shows the great possibilities of narrow-gauge railways in supplying troops in the field. However, in using them it must be remembered that the Barsi Railway was a well built and ballasted line, running under peace conditions. Estimates based thereon for war conditions should be reduced enormously to provide for the necessary passenger service and for the interruptions of traffic due to poor track conditions and to accidents incident to a state of war.

The *narrow-gauge locomotives* built in this country give even better performances than that cited, for an eight-wheel locomotive, 14 by 18 ins., class D. T., built by the H. K. Porter Co., of Pittsburgh, weighing in working order 60,000 lbs., is rated with a capacity of 1,875 tons on the level, 425 tons on a 1% grade, and 220 tons on a 2% grade; while class D. T. locomotive, with 11 by 14 in. cylinders, weighing 36,000 lbs., is rated at 1,075 tons on the level, 240 tons on a 1% grade, and 120 tons on a 2% grade. The *axle load* in the first case is  $7\frac{1}{2}$  tons; the weight of rail necessary is 30 lbs. per yard. The axle load of the second locomotive is  $4\frac{1}{2}$  tons and only requires a 20-lb. rail.

The *rating* of these last two engines is based on the frictional resistance of  $6\frac{1}{2}$  lbs. per ton. This resistance may vary from 5 lbs. to 10 lbs. for good cars and track, and may run higher for poor cars and track.

The *efficiency of locomotives* is being constantly increased, and a study of the latest catalogues of the prominent builders is recommended.

The question of *time* not only enters into the question of construction of the road, but is also an important factor as to the amount and kind of narrow-gauge rolling stock that can be furnished. For a *short line*, say 10 miles in length, it is probable that the equipment and rolling stock could all be bought from stock. This would mean adapting the grade and gauge to the

rolling stock, supplies, etc., that the manufacturers had on hand. For a narrow-gauge line of *considerable length*, say 40 to 50 miles or more, it will be absolutely necessary to have considerable notice, and the same will be especially true if the material is to be transported across the sea. Under either circumstance, the engineer will first fully acquaint himself with all the plans of the commanding general, and ascertain the general line over which the railway is to be built and the probable army that will have to be supplied. A study of the best maps available will then show him the general features of the country through which the line is to run. On over-sea expeditions the list of material may have to be made up from imperfect knowledge of existing conditions.

If a very accurate and *detailed map* is at hand, the work will be simplified; if not, a general *reconnaissance* should be made of the ground to be covered, where such a thing is at all possible. The engineer will, meantime, enter into communication with the manufacturers of railway equipment of all kinds, and he should then be able to make a bill of material for the railroad that is to be built. If necessary, pressure should be brought to bear on the manufacturers to make them rush his order through without delay and in advance of all other similar civil orders.

### Part 3

## THE FRENCH MOTOR TRANSPORT SERVICE

Organization of Units.—To indicate the basis upon which Motor Transport organization is devised, it is incumbent to take a brief glance at the normal transport system as generally developed by the present war.

The motor transport with the Armies may be generally classed into operating units and supply organs. These are all grouped into an Automobile Service, that has its various chiefs and subordinates, and which is organized on the same general lines as the other supply services.

The Director is at the Direction of the Rear, at General Headquarters. His duties are:

1. Supervision of the technical use and maintenance of the whole Automobile Service.
2. Direct command of a certain number of transport agencies and personnel for organization and general upkeep.
3. To insure constant resources by preparing the requests of the General in Chief to the Minister for satisfying the needs of the Armies.

The D.S.A. is assisted by additional officers and a commission of investigation and tests called the *Technical Bureau*.

The Technical Bureau investigates all propositions concerning the material and keeps in touch with the Inspection of Manu-



factures. It makes use of the *Bureau of Control and Improvement of Automobile Material*. (S.C.A.M.A.)

The technical inspection of the various Automobile Services is under two Field Officers. One, the *Technical Inspector of the Parks*, is in charge of all the parks and has to see that the methods of work are uniform. The other, *Inspector of the use of automobile units, traffic and technical inspector of groups*, has to supervise the upkeep, care and use of motor vehicles, in order to obtain the maximum efficiency of the material at the disposal of the Armies.

A Material Transport Section is an administrative unit. It includes from 16 to 20 trucks, according to the available tonnage, and a rolling kitchen. It can transport 35 tons. It is commanded by a First or Second Lieutenant.

Four Sections form one Group, commanded by a Captain or a Senior Lieutenant. A Group can transport the daily food supply for two divisions or two shipments of 75 and two shipments of Infantry munitions.

Six Groups form a Corps and can transport 12 shipments of munitions (Infantry and 75).

When large bodies of troops are to be transported, the automobile unit employed is the Corps composed of 6 Groups and whose carrying capacity is 2 Infantry Regiments of 3 Battalions.

At the head of the Corps is a Corps Commander assisted by 5 officers attached; the *Orienting officer*, the *road commission officer*, an officer whose duty is to collect the cars which break down and send them back to the cantonments, an *officer technician* and a *supply officer*.

The Orienting Officer prepares the transports and fixes the loading points.

The Road Commission Officer marks out the road by means of arrows in day time and lanterns at night.

The rôle of the other officers is indicated by their name.

When personnel is to be transported it is necessary first of all to designate a loading station, one to each Auto Group (one Group carries a Battalion). Several Battalions may be loaded in succession at one station, but they must follow each other at intervals of half an hour at least.

The hours of departure should be so calculated that the Groups will pass the first point marked on the road at intervals of half an hour.

As to the method of loading, numerous experiments have shown the following to be the most convenient:

The Group Commander gets in touch with the Battalion Commander and the battalion is sent in a column of fours in order to make it debouch on the road near the group which is to transport it. The Automobile Group Commander divides the column in four lines each one of which is put in charge on each

of his Section Chiefs who brings it up to the front of his Section where the assistant drivers are assembled. The Section Chief forms the men into groups corresponding to the carrying capacity of each car. The groups thus formed are conducted by the assistant driver to his car and loaded.

Under normal conditions a group on the march has a length of 2 kilometers; with the interval required between each Group, the total length of a Corps is about 25 kilometers and takes 2 hours to 2 hours and ½ to pass by a given point.

*Formation of a Group*

*Headquarters of the Group:*

- |                         |                               |
|-------------------------|-------------------------------|
| 1 Captain Commanding.   | 1 Adjutant (Warrant Officer). |
| 1 Lieutenant Assistant. | 1 Bicyclist.                  |

The Captain or his Adjutant report daily at a fixed hour to the Chief of the Army Automobile Convoy for instructions and transmit these instructions to those interested.

*A Group is Composed of Four Sections.*

*Formation of a Section:*

*Personnel:*

|  |    |
|--|----|
| Lieutenant or 2nd Lieutenant (Chief of Section)..... | 1  |
| Sergeant .....                                       | 2  |
| Quartermaster Sergeant .....                         | 1  |
| Corporals .....                                      | 2  |
| Mechanicians .....                                   | 4  |
| Chauffeur of Touring Car .....                       | 1  |
| Chauffeurs of Auto-Trucks .....                      | 20 |
| Assistant-Chauffeurs of Auto-Trucks .....            | 20 |
| Shoemaker .....                                      | 1  |
| Tailor .....   | 1  |
| Cook .....   | 1  |
| Bicyclist .....                                      | 1  |
| Motor-Cyclist .....                                  | 1  |
| Total .....  | 56 |

*Auto-trucks and Automobiles:*

|                          |    |
|--------------------------|----|
| Touring Car .....        | 1  |
| Transport Trucks .....   | 18 |
| Baggage Auto-truck ..... | 1  |
| Repair Auto-truck .....  | 1  |
| Total .....              | 21 |

*Bicycles and Motor-cycles:*

|                   |   |
|-------------------|---|
| Bicycle .....     | 1 |
| Motor-cycle ..... | 1 |
| Total .....       | 2 |

The Section is divided into 2 half-sections and each one-half section into 2 squads.

The first one-half section is commanded by the senior sergeant, the second half section is commanded by the junior sergeant. The second squad of each one-half section is commanded by a corporal.

#### *Upkeep of Auto-trucks:*

Each morning, about half an hour after reveille, the sergeant of the day inspects all the auto-trucks for the purpose of seeing that nothing has been left in the interior of the auto-truck which may be lost, or that no unauthorized material is carried; that the auto-truck is clean, and that the chauffeur and his assistant have cleaned the mechanical parts as well as the interior of the body of the machine, and that every thing is in order. He also inspects the tanks to see that they are filled with gasoline. Each machine carries as a reserve 2,000 litres of gasoline over and above that in the tanks, and the sergeant inspects the supply daily to see that it is complete. It is formally prohibited to touch this reserve for any reason whatsoever while the machine is parked.

#### *Repairs:*

All chauffeurs are required to notify their corporals or sergeants of any repairs that should be made to their machines so that the attention of the senior mechanic may be called to them. These reports are made every morning. The senior mechanic lists all such work that must be done and assigns one of his assistants to carry it out. The repair auto-truck is under the immediate orders of the senior mechanic, no chauffeur can touch any of its equipment without his authorization.

#### *Disabled Auto-trucks:*

The sergeant of the day reports each morning at 8 o'clock the number of machines which are out of order to the Captain Commanding, at the same time he reports why such machine or machines are out of orders.

#### *Consumption of Gasoline and Lubricating Oil:*

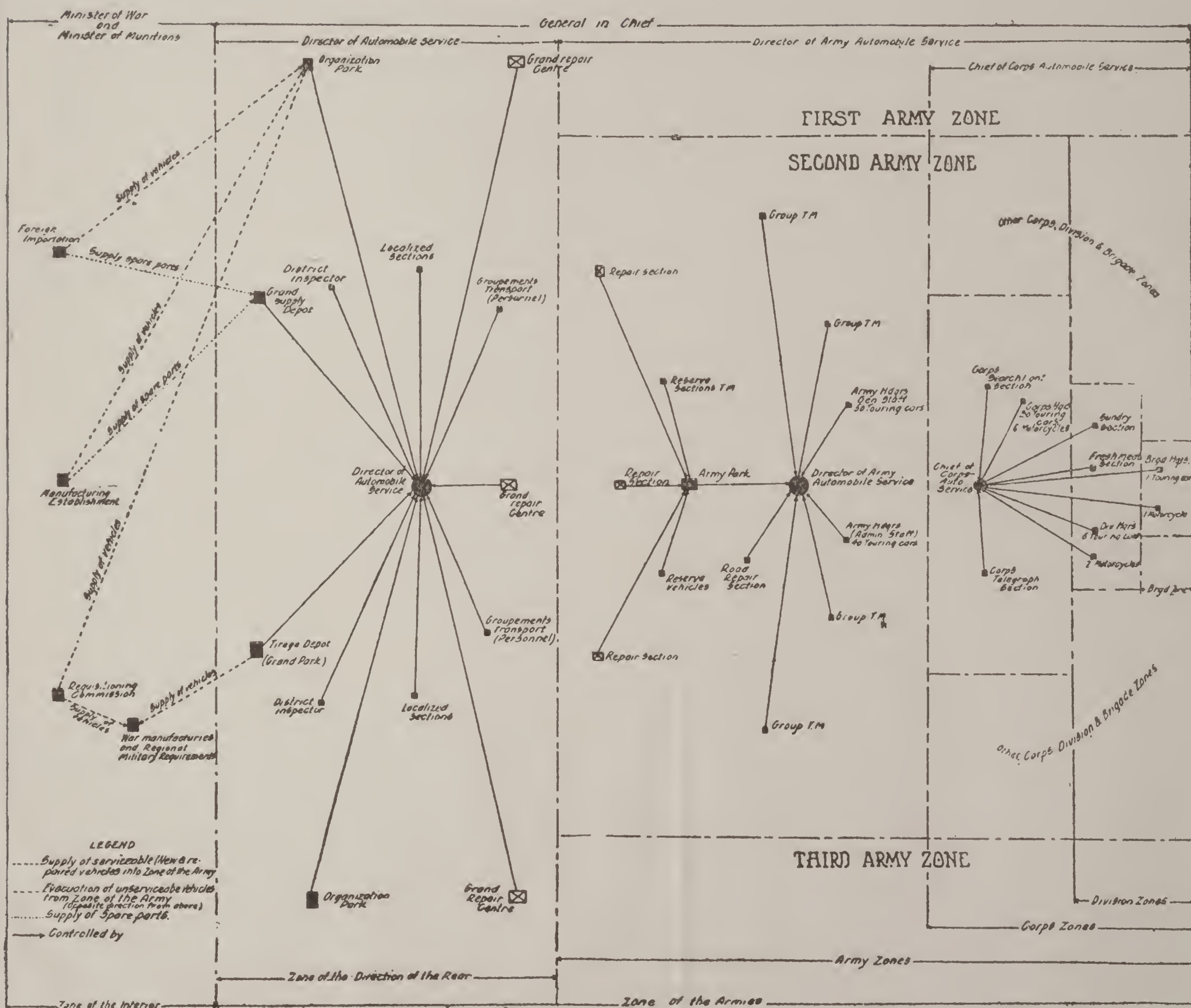
One of the non-commissioned officers of the Section is designated to keep track of and report upon the amount of gasoline and lubricating oil used by each machine. Each morning he reports the exact amount of gasoline and lubricating oil consumed the preceding day and the number of kilometers such machine has made during the day. From time to time the senior mechanic verifies these reports so as to determine whether or not the excess explained is the fault of the chauffeur or some engine trouble.

All the activities of this Service are directed to keeping the operating transportation units in full working condition.



The following diagram of the French Army Automobile Service Organization will illustrate the paragraphs above:

# FRENCH ARMY AUTOMOBILE SERVICE ORGANIZATION



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Those units are either groups of automobiles for transporting supplies and personnel (truck sections, companies, or groups) or are detached vehicles operating singly (orderly cars, various headquarters cars,) etc.

**Parks.**—To keep the vehicles of these units in repair, to supply personnel, or to replace useless vehicles, there are established a series of organs known as automobile parks. These are of the same general type, but vary according to the particular purpose for which established.

**Army Automobile Park.**—The Chief of the automobile service of an Army has an Army Automobile Park under his orders and located within the zone of the Army. This park is a mobile formation in that it must follow the movements of the Army, and must be able to move within five days from the receipt of the order therefor.

This Park consists essentially of a vehicle Park, a depot of parts and supplies, a depot of personnel, and one or more repair sections, each consisting of a machine shop truck and necessary trained workmen therefor.

It is so organized that one repair section can move out at a moment's notice, and that a 1st echelon of the Park may move in 48 hours thereafter, and the remaining 2d echelon three days after the first.

The Army Park is equipped to make repairs to vehicles not requiring more than 15 days therefor. It also has a depot of parts and supplies for repair work or replacement. It has a park of vehicles that can be sent out to replace immediately an un-serviceable vehicle in a company or elsewhere, so as to keep the unit at its full operating capacity. There is also a depot of personnel, consisting mostly of casualties that may be sent to replace casualties among the personnel of the different operating units.

**Grand Repair Centers.**—With each group of two or more Armies are establishments known as Grand Repair Centers. Those are located to the rear of the Automobile Parks, in the zone of the Rear, and are under the general authority of the Director of the Rear of the Group of Armies.

The purpose of these Repair Centers is to make the repairs that cannot be made in the Army Automobile Parks, either on account of lack of facilities, lack of time (as when an Army Park moves and has to leave its unfinished work in place) or in periods of rush work that the Park can not handle.

The Grand Repair Center receives vehicles from the Army Park that cannot be repaired within 15 days; and after repair, returns them to the Park from which received. It may also receive vehicles in times of rush work, and likewise may detach temporarily to the Army Park several repair sections to assist in the work of the Park during such times.

**Salvage Park.**—There is a special park established for several armies and known as a "Salvage Park." Vehicles arrive

at this Park generally in pieces and on a freight car. From the assortment of materials thus brought in, vehicles are remade, but instead of being returned to the Army, are sent into one of the Parks of Organization, where they are practically taken up as new.

In the French Salvage Park, approximately three-fourths of the material turned in is rendered into serviceable vehicles, thus effecting a great saving.

Park of Organization.—The parks of organization are the main sources of supply for the Automobile Service, and the source from which operating units, equipment and personnel are drawn. There may be several of these parks, each of which receives one or more makes of vehicles, forms them into sections or companies, mans them, and sends them to the front. It also is the ultimate source of supply for vehicles, equipment, supplies and personnel, though the main stock of spare parts and supplies may be kept in a Main Depot not pertaining to the Park Proper.

The Park of Organization is charged with registering all vehicles, preparing descriptive cards, securing personnel for the Automobile Service and training them, either as chauffeurs, mechanics, or motorcyclists: organizing repair centers. In short it is the organ that organizes and supplies the activities of the Automobile Service.

## REPAIR AND REPLACEMENT OF VEHICLES

### *Turning a Vehicle into the Park for Repair*

(A) Sending the vehicle, or notifying the Park:

1. If the Formation does not pertain to the Automobile Service, the Commandant of the Formation should make a request, either in writing or by telephone, on the Commandant of Automobile Park. This letter refers it, if necessary, to the Chief of the Army Automobile Service and gives to the Commandant of the Formation, with the least practicable delay a response indicating the manner in which the vehicle should be brought to the Park.

When the vehicle cannot travel under its own power, and when the Formation can neither tow nor transport it, the Commander of the Formation will indicate, in writing, or, if necessary, by telephone or telegraph:

The kind of vehicle.

The exact place where it is broken down.

The nature of the damage, especially if it is in the wheels or an axle.

It is recalled that a vehicle should never be abandoned, but that the drivers should remain with it until the Park takes delivery thereof.

In the very exceptional case where a driver cannot be left the formation should remove the easily demountable parts: mag-

neto, carburetor, horn, etc., which will be turned into the Park.

2. If the Formation pertains to the Automobile Service, it will be governed by the rules prescribed by the Chief of the Army Automobile Service, relative to putting a vehicle in repair.

(B) Drivers of the Vehicle.—A vehicle to be put in repair should always be accompanied by its driver. These are quartered and subsisted at the Automobile Park. They are utilized either in the cleaning and repair of the vehicle, or for general duties in the Park.

In exceptional cases, where the drivers, for sufficient reasons, cannot be kept at the Park with their vehicle, they will be returned to their Formation after having completed the cleaning of the vehicle.

(C) Papers relative to the vehicle and its drivers.—The driver of the vehicle should have a travel order, signed by the Commander of the Formation or with his authority and indicating the hour of departure.

He should be furnished with a ration certificate for his subsistence at the Park.

He should also have the Record Card of his vehicle and, if necessary, the Record of Issues.

The Formation should indicate, with the least impracticable delay, as stated above, whether new parts have been requisitioned for the vehicle, and the number and date of the requisition.

The Formation may specify in a note the work in detail that it wished to have done. This indication in no wise obligates the Park, which remains the sole judge as to the expediency of the repairs or changes.

(D) Taking in charge by the Park.—The Commandant of the Park, when the vehicle has entered his Park, notifies the Commander of the Formation, and informs him of the approximate date on which the vehicle will be repaired.

When it concerns a Formation not pertaining to the Automobile Service, the Commandant of the Park always gives a receipt for the vehicle.

### *Return by the Park of a Repaired Vehicle*

(A) Inspection of the vehicle.—When the repairs are terminated, the Park should always give the vehicle a tryout. The result of this test is entered on a special bulletin kept by the Park.

Notation of the repairs is entered on the Record Card of the Vehicle.

(B) Return of the vehicle to its Formation.—The vehicle is sent to the Formation with its drivers.

If the vehicle has been taken without its drivers by the Park, it is the duty of the Commandant of the Park to arrange with the Formation Commander the method by which the vehicle



will be sent back. Normally it is the duty of the Formation to send to the Park the drivers necessary to get the vehicle.

The driver leaving the Park is furnished a travel order signed by the Commandant of the Park, indicating the hour at which the vehicle leaves the Park. This driver should also be furnished a ration certificate, should have the Record Book of his vehicle and, if issued, the Record of Issues.

### *Evacuation of a Vehicle to the Rear*

If the Automobile Park cannot assure the repair by its own means, it is directed to a Park in the rear.

In this case, the Chief of the Automobile Service advises the Commander of the Formation concerned as to whether the vehicle will be returned after a repair of long duration, or whether it will be sent definitely to the rear.

The vehicles belonging to the Aviation are never turned into Parks of the Rear, but when the repair will be of too long duration to be undertaken by the Army Park, they will be sent to the Aviation Park.

For every vehicle not on the property papers of the Automobile Service, the Commander of the Formation concerned should advise the proper establishment in specifying whether or not a vehicle of the same category has been received in exchange. It forwards to this establishment, as a voucher, the receipt given by the Commandant of the Park when the vehicle was turned in for repairs. The establishment can therefore take the proper steps to drop the vehicle from their accounts.

In doubtful cases, additional information may be demanded by this Establishment from the Direction of the Rear, Direction of Automobile Services.

While the Tables of Organization of our transport service do not closely correspond to those of the French, it is natural to expect that its work will conform closely to the general French scheme of parks, repair centres, and depots.

## Part 4

### MOTOR TRANSPORTATION EQUIPPING AND ASSEMBLING UNIT

A Motor Transportation Equipping and Assembling Unit has recently been organized under the Quartermaster General, the personnel and workings of which are described in the following circular from the Quartermaster General of Jan. 5, 1918:

The following organization and operation of a Motor Transportation Assembly and Equipping Unit, are based on actual experience and practice developed on the line of communication of the American Expeditionary Forces in Mexico and at the Motor Storage Detachment, Fort Bliss, Texas.

## ADMINISTRATION DEPARTMENT

|                  |                              |
|------------------|------------------------------|
| 1 Captain        | Commanding                   |
| 1 1st Lieut.     | Receiving and Shipping       |
| 1 1st Lieut.     | Equipping                    |
| 1 2nd Lieut.     | Property for Equipping       |
| 1 Q.M. Sergeant  | Acting 1st Sergeant          |
| 1 Sergt Q.M.C.   | Acting Supply Sergt. of Unit |
| 1 Sergt. Q.M.C.  | Acting Mess Sergeant         |
| 5 Sergts. Q.M.C. | Clerks                       |
| 6 Cooks          | Acting Buglers and Orderlies |
| 1 Corporal       |                              |
| 2 Privates       |                              |

The Captain should be selected for his executive and administrative ability, with a fair knowledge of Motor Transportation equipment as applied to the Quartermaster Corps.

The 1st Lieutenant in charge of the Receiving and Shipping Department should be well versed in the different kinds of equipment used, and all papers such as invoices, requests for invoices, bills of lading, etc.

The 1st Lieutenant in charge of the Equipping Department should have an excellent knowledge of all equipment, use and manner of attaching same, with a fair knowledge of light blacksmithing, body installation, painting, electrical equipment and installation, and testing of trucks, automobiles and motorcycles.

The 2nd Lieutenant in charge of the Property for Equipping should be well versed in the equipment used on trucks, automobiles and motorcycles. The establishing of a warehouse system for receiving, issuing and accounting for all property with great rapidity.

The Q.M. Sergeant should act as the 1st Sergeant of the company and Chief Clerk, with one Sergeant, Q.M.C., to assist him in all company records.

One Sergeant, Q.M.C., should act as Mess Sergeant.

One Sergeant, Q.M.C., should act as Property Sergeant, in charge of all company equipment, with one Corporal to handle the issuing and accounting of all tools used by company personnel.

Four Sergeants, Q.M.C., should handle all invoices and property accounts.

## RECEIVING AND SHIPPING DEPARTMENT

- 1 Sergt. 1st Class, Q.M.C.
- 4 Sergts., Q.M.C.
- 4 Corporals
- 5 Privates, 1st Class
- 7 Privates

*Working in Close Harmony with the Property and W.H. Dept.*

This Department should receive and carefully check all incoming and outgoing property, turning same over to the Property and W. H. Department, and all records of receipts and shipments to Administration Office.

One Sergeant 1st Class as foreman, with 4 Sergeants as assistants.

The Corporals and Privates 1st Class should be drivers; and the Privates, laborers.

A subdivision of this Department which could be changed by the Sergt. 1st Class to meet existing conditions, follows:

1. One Sergt. with one Corporal should do all checking.
2. One Sergt. with one Corporal, 3 Pvts. 1st Class and 3 Privates, could sort, move and store all bodies.
3. One Sergt., with one Corporal and 2 Pvts., could gas, oil and store all trucks.
4. One Sergt., with one Corporal, 2 Pvts., 1st Class, and 2 Privates, could tire, gas, oil and store all automobiles and motorcycles.

## PROPERTY AND WAREHOUSE DEPARTMENT

- 1 Sergt., 1st Class, Q.M.C.
- 3 Sergts. Q.M.C.
- 3 Corporals
- 5 Privates, 1st Class
- 13 Privates

*Working in Close Harmony with the Receiving and Shipping Department*

This Department should receive from the Receiving Department and issue to the Equipping Department all property as desired for equipping purposes; also issue to the Shipping Department for shipment all case goods and completely equipped trucks, automobiles and motorcycles.

A complete record should be kept, showing the disposition of all property.

A subdivision of this Department which might be changed by the Sergeant 1st Class to meet existing conditions, follows:

1. One Sergeant, with one Private, 1st Class, for warehouse office, compiling all receiving and issuing property records, showing the disposition of all stores.
2. One Sergeant with 2 Corporals, 3 Privates, 1st Class, and 8 Privates could handle all open stock.
3. One Sergeant with one Corporal, one Private, 1st Class, and 5 Privates could handle all tires, case lot goods, trucks, truck bodies, automobiles and motorcycles.



## EQUIPPING DEPARTMENT

1 Sergt., 1st Class, Q.M.C.  
8 Sergts. Q.M.C.  
8 Corporals  
168 Privates, 1st Class  
48 Privates

This Department should receive from the Property and Warehouse Department all trucks, automobiles and motorcycles, drawing all necessary equipment and installing it, also testing every vehicle, being sure same is in perfect working order before returning it to the Property and Warehouse Department.

Should a vehicle be found in an unserviceable condition, which could not be rectified by minor adjustments or repairs, a complete report to the Commanding Officer should be made, recommending that the vehicle be sent to the nearest Q.M. Mechanical Repair Shops for repairs.

The personnel of this Department can be divided into 8 distinct branches each having one Sergeant, one Corporal, 21 Privates, 1st Class, and 6 Privates. These divisions might be changed, however, by the officer in charge of the Department, to meet existing conditions.

1. *Blacksmithing*, comprising the making and installing of U-bolts and saddle plates for body sills, special length bolts, side rails and cleats for holding equipment.

2. *Carpentry*, comprising the fitting of sills, bolsters and body beds, making of cleats and chocks for holding equipment, and if necessary assisting in crating motorcycles and heavy equipment for shipment.

3. *Body Mounting*, comprising installation of side boards, tail gates, head boards, and securing bodies to frame.

4. *Painting*, comprising truck, automobile and motorcycle painting, lettering and numbering same.

5. *Equipping*, comprising the installation of headlights, side lights, tail lights, horns, auxiliary tanks, bows and tarpaulins.

6. *Electrical*, comprising battery testing and installation, connection of, and testing all wiring for lights and power units.

7. *Automobile and motorcycle*, comprising equipping with lights, tops, cushions, extra tires and tools.

8. *Testing*, comprising a thorough check of all equipment, a thorough examination of complete vehicle, and a good road test, furnishing the Sergeant, 1st Class, of Department with record, when turning vehicle as ready for shipment back to the Property and Warehouse Department.

Should the conditions warrant, the Sergeant, 1st Class, of Department could use any number of men from any of above Branches for moving a large number of vehicles at one time

or assisting the Receiving and Property Department in moving large quantities of heavy stores or trunk bodies.

The unit is amply equipped with tools both for general use and the individual use of mechanics for all the above operations.

## Part 5

### TRANSPORTATION OF TROOPS

(A) Railway Transportation.—Preference to military traffic.

In time of war or threatened war preference and precedence shall, upon the demand of the President of the United States, be given over all other traffic to the transportation of troops and material of war, and carriers shall adopt every means within their control to facilitate and expedite the military traffic. (34 Stst., 587.)

Movement by commercial railways is function of Q.M.C.

The movement of troops and their equipment over commercial railways is the function of the Quartermaster Corps, who plan and prepare for the move in conformity with the regulations and orders from competent authority. (F.S.R., 388, 1914.)

Quartermaster should work out Movements in advance of Orders.

In order to have complete data available at all times for expeditious rail movements, every quartermaster should maintain on file the consist of equipment necessary to move the entire command at his station as a whole, as well as the separate units. He should consult his commanding officer in reference to the arrangements of train sections and should complete his files by listing the supplies and equipage to accompany the troops under varying conditions.

Notice of Movements.—Commanding officers will give timely notice to the proper officers of the Quartermaster Corps of all contemplated movements of troops and supplies, that proper and sufficient transportation may be in readiness. (A.R., 1107, 1913.)

Detailed list of Command to be Furnished.—Two estimates of rail transportation (Q.M.C., Form 469) will ordinarily be required when organizations are moved by rail. The first is a preliminary estimate giving the shipping quartermaster the data to enable him to order the necessary cars and have them properly placed, and the final one is an exact return of the officers, enlisted men, civilian employees, animals, and vehicles. Separate estimates are necessarily required for each train section. They should give, in each instance, the following data:

(A) Organization and Headquarters.

(B) The number of the Train section (No. 1 being the first to depart, No. 2 the second, etc.).

(C) Destination.

- (D) Name of train quartermaster.
- (E) Authority for the movement.
- (F) The number of officers and enlisted men, separately, for each arm and corps omitting live-stock attendants.
- (G) The number of civilian employees, omitting live-stock attendants.
- (H) The number of live-stock attendants.
- (I) The number of public mules, public horses, and authorized private horses, separately for each.
- (J) The number of wagons, ambulances, guns, caissons, and other vehicles, separately for each.
- (K) Approximate total weight of organization property, household goods, and checkable baggage, separately for each of the three items, should also be shown in the preliminary estimate, but not in the final one, such information being then given in the shipping lists and invoices (Par. 182 & 183).

The date of entraining and approximate hour of departure should be stated in the preliminary estimate in case the order or other instruction directing the movement of troops fail to give that information.

Informal award.—In expedited movements bids need not be invited. Preliminary should be furnished the carriers orally, or by telephone, or telegraph, but in any event, a letter of advice will be furnished the carrier.

Sample Letter of Informal Award.—The following example covers the general case:

Office of the Quartermaster,

Fort, ....., 1917.

From: Quartermaster.

To: (Superintendent or Agent) .....Railroad Company.

1. It is requested that the .....Railroad Company furnish transportation from ..... to ..... via ..... for approximately the following:

.....Officers  
 .....Enlisted men  
 .....pounds of freight  
 .....animals  
 .....vehicles

Officers to be furnished one berth each in standard sleeper; the enlisted men to be accommodated three to a section in tourist sleeper.

2. It is estimated that the following equipment will be required:

- ..... Pullman sleepers ..... sections each.
- ..... Tourist sleepers, ..... sections each.
- ..... Baggage cars, with end doors.
- ..... Kitchen cars.
- ..... Box cars, ..... feet long.
- ..... Stock cars, ..... feet long.
- ..... Gondola cars, ..... feet long, with drop end.

If tourist sleepers are not readily available, coaches should be substituted on the basis of one man to each double seat, and an endeavor made to secure tourist sleepers and transfer the men thereto at a convenient place en route. (See \* below.)

If end door baggage cars are not readily available, substitute an equal number of solid-end baggage cars.

If kitchen cars are not readily available, an extra tourist car should be supplied.

If drop-end gondolas are not readily available, solid-end gondolas will *not* answer, but an equal number of flat cars should be supplied.

3. It is desired to get troops under way as soon as practicable, and it is therefore requested that delivery of equipment be expedited. It is estimated that the first train section will be ready to leave about ..... o'clock, ....., 191.., and will be followed as rapidly as possible by the other sections.

4. It is understood that 150 pounds of personal checkable property per capita belonging to officers and men will be carried free.

Sufficient space to be reserved in baggage cars free of charge for subsistence en route. The men to be allowed to take their arms and necessary hand baggage for the journey with them in the passenger cars without charge.

All cars to be of standard quality and in good order and sanitary condition; passenger cars to be properly watered, lighted, and heated; stock cars thoroughly cleaned and bedded with clean earth, sand preferred. All equipment to be placed at point of embarkation in time for inspection before movement; freight cars to be placed in readiness at the most convenient points sufficiently in advance of passenger cars to admit of the

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\* NOTE: When the approximate time required for the journey is 24 hours or less substitute the following:

"If tourist sleepers are not readily available, coaches should be substituted on basis of three men to each two double seats."



loading of freight and preparation of bills of lading prior to the embarkation of troops.

5. It is requested that this office be notified promptly as to whether or not your company will furnish the above-described transportation.

In case your company can furnish transportation, information is also desired as to date and hour equipment will arrive and be ready for use. Upon receipt of this information you will be furnished instruction as to placing of cars and make-up of trains.

.....  
 .....

Request for Freight Equipment must show length of cars desired.—Attention is invited to the fact that an additional charge is assessed in some cases for freight cars (including stock cars) in excess of 36 feet in length, unless such cars are furnished for convenience of the carrier. In ordering freight equipment the Quartermaster should therefore specify the length of cars desired and should not order a 40-foot car when a 36-foot car will answer the purpose.

Units should be kept together.—Whenever organizations are moved by rail, with their animals, equipment, and material, it is desirable that complete units be kept together in trains divided into convenient train sections. It is preferable to have trains of moderate size with good speed rather than long trains with low speed. If it is necessary to divide a train, some officers and men will accompany each section. The troops should not be separated from the animals, material, and equipment A if it can be avoided; but if the animals are shipped in separate detachments under officers accompany them, and such sections will precede the troops. (F.S.R., 390.)

Size of Trains.—For commands of four companies of Infantry, for one field battery (light), for a troop of Cavalry, or larger movements, it is always better to arrange for special trains made up to include the freight cars carrying the command's freight. This insures the arrival together at destination of the troops and property of the command, but will retard the movement of the troops themselves, as trains carrying freight cars can not make the same rate of speed as those composed wholly of passenger equipment.

Size of Train Sections.—Under the most favorable conditions a single section of a troop train should not consist of more than 20 cars.

The number of engines available, the kind and capacity of cars, the condition of the roadbed, especially as to curves, grades, and physical condition, the strength of the command in officers, men, animals, and vehicles, and whether the freight taken is incidental to change of station or is limited to field allow-

ances, are all determining factors in ascertaining the size of train sections.

Under ordinary conditions a section of a railway train will carry the following organizations at war strength:

- 1 battalion of Infantry, or
- 2 troops of Cavalry, or
- 1 battery of Artillery (light), or
- 1 company of Engineers with bridge train.

Breaking up of Tactical Units to be Avoided.—The breaking up of tactical units should be avoided, but, as the size of the trains will be left to a great extent to the railroad officials, it will not always be possible to prevent it, and in case units are to be broken it is essential that the commanding officers know in advance how their troops are to be carried, in order that arrangements can be made for provisioning and caring for the troops in each section.

Railroad should be furnished full Information.—In furnishing the consist of trains, and sections thereof, the fullest possible information should be furnished the railroad authorities in order to avoid unnecessary shifting of cars or reversing of their relative positions after the cars have been delivered for loading.

Placing Equipment.—The freight and baggage equipment should be called for in ample time to advance to permit of a thorough inspection, careful and methodical loading without hurry or confusion, and to allow time for assembling the fatigue details between the conclusion of the loading of freight and baggage and the time fixed for the entraining of the troops. As a rule, the railroads will have little difficulty in furnishing the freight and baggage equipment in advance of the passenger equipment, though when the command is small or the amount of freight and baggage is small, it will be found simple to set in the entire equipment at one time. Where there are several trains to be moved, however, this is undesirable, as they occupy too much trackage, and if made up entire the freight and baggage cars are likely to be inconveniently placed for loading. In such cases the freight, baggage, and stock cars should be set in advance and conveniently placed for loading.

Tourist sleepers for Troops and Officers.—Tourist sleeping cars will be provided for troops on the basis of three men to a section when the journey involves spending a night on the train; but when the number of troops is too small to justify the hiring of tourist sleepers, tourist sleeping-car accommodations on the same basis, if available, may be furnished (if the movement is made on a regular train carrying such cars). When the number of officers traveling with troops is too small to justify the hire by the Quartermaster Corps of a standard sleeping car for their accommodation, they will be furnished with such part of a tourist sleeping car, or other suitable sleeping



car properly curtained off for their accommodation, as the Quartermaster Corps may provide for their use during the journey, one lower berth to be furnished to each officer if practicable (AR., 1128, 1913).

Special sleeping or parlor cars will not be chartered when the expense exceeds the cost of the berths or seats authorized to be furnished (A.R., 1132, 1913).

Minimum number for whom Special Cars will be Furnished.—The provisions of these clauses of Army Regulations, 1128 and 1132, are often misconstrued. All railroads require the equivalent of a certain fixed number of fares if a special car is furnished, and the term "special car" includes either a standard or tourist sleeper if used exclusively by a party. This minimum varies from 18 to 25 fares, and Quartermaster should not, therefore, arrange for the hiring of tourist or standard sleeper for parties of less than 25 unless the carrier specifically agrees to charge only for the number actually in the party, without regard to any requirements as to a minimum of fares. This rule does not apply in movements of more than 25, provided the number of persons transported averages 25 to the car. For example, if a party of 60 is traveling, and two cars are used, there is no objection to placing 20 in one car and 40 in the other.

Tourist Berth for Officers.—If a movement consists of only one or two troops or companies the number of officers would be too small to justify the hire of a standard sleeper, and the regulations are explicit in stating that a lower berth in tourist sleeper only, will be furnished each officer under such circumstances. If an officer desires an entire section he must pay for the difference from personal funds, as no payment will be authorized for an unoccupied upper berth of a section, even though the lower berth of this section is occupied by an officer.

Standard Sleepers for Officers.—Under the provisions of paragraph 1128, A. R., 1913, an officer traveling with troops is entitled to and should be furnished with standard sleeping-car accommodations when standard sleeping-car accommodations are available and can be used by him in connection with his orders directing him travel with troops, the troops in such cases being accommodated in a tourist car attached to a regular train to which is also attached a standard sleeping car for the accommodation of the general public. In movements of a battalion, squadron, or a larger unit, standard sleepers will be furnished for the officers on the basis of one berth for each officer, a lower if practicable, otherwise an upper. The furnishing or use at public expense of a drawing room or compartment for individual officers is unauthorized.

Tourist Cars for Troops.—In all cases where tourist cars are used for troops, berths will be provided for the men on the basis of three men to a section, the men in excess of this multiple being given an upper berth each.

Excess Berths furnished, Charged against Officer.—The number of berths authorized by Regulations only can be paid for from public funds. If an excess number of berths are called for and furnished on a request, the cost of such excess will be charged against the officer issuing the request. If an excess number of berths, not called for by the request, or tickets are used in transit the officer in charge of the train will be called upon for a remittance to cover the cost of the unauthorized berths.

Equipment used for preparation of Food en route.—In movement by rail kitchen cars are provided, if practicable, and the length of the journey warrants; otherwise, baggage cars are fitted up by the troops, or arrangements are made for procuring meals, or at least liquid coffee, at station en route.

Careful attention is paid to the messing of the men, whether in kitchen cars or in the coaches where the men ride. A mess officer supervises the preparation and serving of the meals and requires the men to keep their mess kits scrupulously clean. (F.S.R., 397.)

The different equipments used for the preparation of food for recruits and organizations in movements by rail are:

- |   |                              |
|---|------------------------------|
| (A) The kitchen tourist car, furnished by the Pullman Co. |                              |
| (B) The regular kitchen-car equipment                     | Furnished by<br>the Q. M. C. |
| (C) The emergency kitchen-car equipment                   |                              |
| (D) The portable gas cooker                               |                              |

NOTE.—The detachment mess car is no longer furnished.

Kitchen Cars, Description of.—The Pullman Co. have in service certain cars that are known as kitchen tourist cars. These are 16-section tourist cars with 2 sections removed, in which the company has installed a range and cooking equipment. With the cook and cook's helper provided by the Pullman Co., who are familiar with the use of the cooking appliances and the storage of food supplies, one of these cars is capable of preparing meals for as many as 300 men. The 14 sections remaining in the car can be used the same as any other tourist car, and will therefore accommodate 42 men, on the basis of 3 men to a section.

Use of Kitchen Cars.—In the movement by rail of recruits or organizations, when special train service is provided and the time required for the journey will exceed 48 hours (with troop trains this will usually mean a journey of about 800 miles), and the number of men to be transported is 30 or more, kitchen tourist cars will be provided for the journey whenever practicable at the rate of 1 for each 200 men, or fraction thereof, and arrangements made with carriers to furnish a sufficient number of tables for each troop car. The kitchens will be completely equipped by the contractor for the preparation of meals, and a sufficient number of deep enameled plates to properly serve the troops will be provided as a part of the kitchen equipment.

Emergency Kitchen Equipment.—If time will not admit of securing the kitchen equipment, a field range, No. 1, may be installed in the baggage or other car as an emergency kitchen-car equipment.

Installing Field Range.—The method of installing this range in a baggage car will be as follows: Construct a box 6 feet long by  $24\frac{1}{2}$  inches wide and about 12 inches deep, inside measurements, using  $1\frac{1}{2}$  or 2 inch material if available. Line the sides, ends, and top edge of box with galvanized iron or zinc. Place box in car running lengthwise on one side of the car about 2 feet from the side. Fill the box with dirt up to about 2 inches of the top. Place a brick flush with top of dirt at each of the four corners where the range will set. Place range in box, front and oven end close up against end of box, and deep enough in box so that when oven door is opened it will lay flat on edge of box. Place boiling plate in box, the end resting on top of angle iron on rear of range. Place a brick under each front corner of boiling plate flush with top of dirt. The alamo attachment is not used when range No. 1 is installed in the above manner. Fasten range and boiling plate firmly to box by means of strap iron or two or three strands of telegraph or telephone wire. Fill space between range, boiling plate, and side of box with soft mud to prevent heat from escaping. Three, and even four, field ranges may be installed in a car. Box can be held firmly in position on floor of car by nailing 2 by 4 inch strips around sides and ends of box. This is important and must not be neglected.

Installing Stovepipe.—Remove one of the ventilating windows from car; tack tent guards furnished with each range over the opening—one on the outside of the car and one on the inside. Carry stovepipe up and through the opening. End of pipe should extend about 6 inches outside of the ventilator opening. Elbows should be placed on end of pipe facing up and wired firmly to car. Wire stovepipe firmly to both sides of car.

Additional Equipment Necessary.—The following additional equipment to that supplied with each range is necessary:

Two galvanized iron water cans.

Two galvanized iron buckets.

One elbow stovepipe.

One hundred feet wire.

Water cans should be filled on every possible occasion where stops are made.

Installing Stovepipe if Box Car is Used.—If the equipment is to be set up in a freight car a hole would have to be cut in top of the car for the stovepipe, using tent guards, as explained in above paragraph, to cover the opening. A freight car should not be used unless *absolutely* necessary, as the Government will be compelled to pay for the repairs necessary to replace car in proper condition.



Advice to Commanding Officer as to Placing of Cars.—When the number of trains, or sections, is determined the commanding officer will be advised by the quartermaster where the freight and passenger equipment for each section will be placed and the time when the equipment will be in position for loading.

Marking Cars.—As soon as freight cars are placed the quartermaster will mark the cars, in chalk, with the letters of the organization to which they are assigned. Passenger cars will not be marked until after the train sections are made up.

Quartermaster to be Present at Entraining.—The quartermaster who provides the transportation, or a duly authorized representative, will be present at the embarkation of the troops and will see that the accommodations contracted for have been provided. A similar course will be pursued, where practicable, at places where changes of route or important connections are to be made. If delay is necessary in either case in order to complete the arrangements for transportation the commanding officer of the troops will be fully notified. (A.R. 1114, 1913.)

In accordance with the foregoing paragraph of Army Regulations the Quartermaster furnishing transportation, if practicable, and if not practicable, his agent, should be present at the loading of freight and troops. He should examine the train and its equipment and see that the railroad company has complied fully with its agreement. His presence is necessary also to adjust matters in case of controversy between the agents of the railroad and the commanding officer of the troops.

Order of Loading.—The following order should be generally observed in loading:

First.—Company property, equipment, and supplies, not needed in transit (in box cars locked and sealed by railroad employees prior to departure of train), viz.:

- Company property.
- Property of officers and men.
- Ammunition.
- Rations.
- Sanitary stores.
- Tentage.
- Cooking utensils.

Second.—Transportation (on gondola or flat cars), viz.:

- Guns and artillery carriages.
- Pontoons.
- Wagons.
- Ambulances.
- Other vehicles.

Third.—Forage (in box cars).

Fourth.—Checkable baggage, rations for use en route and arms (in baggage and kitchen cars under guard).

Fifth.—Animals (in stock cars).

Sixth.—Men (in coaches or sleepers).

By this arrangement the articles needed first will be unloaded first. The cars should be allotted, marked, and loaded as prescribed in paragraphs 179 to 196 of the "Handbook of Transportation by Rail."

**Arrangements of Cars, if Two or More Sections.**—If the organization is to be shipped in two or more sections, see that the proper baggage cars accompany each section, so that when an organization arrives in camp its baggage will be with it. At least two men should be in each unsealed car containing baggage or rations.

**Duties of Officer Supervising Loading.**—The officer designated to superintend the loading of each train section should keep a list showing the initials, number, and contents of the cars loaded under his supervision; should see that there is no unnecessary delay in placing the freight in the cars; that the cars are fully loaded; and that the work is properly done. He should also see that household goods are loaded in separate cars (provided there is sufficient quantity to make one or more carloads), and that all checkable baggage (the 150 pounds per passenger each carried free) is likewise in separate cars provided for the purpose. As far as practicable the property of each organization should be kept by itself, and the property should be placed in cars in the order indicated herein. He should see that cars are, as far as practicable, loaded to their full capacity, as the railroad tariffs provide a minimum weight (usually 30,000 pounds) for each car used, and the charge for this weight is assessed even though the car may contain only 18,000 or 20,000 pounds, or a less number of pounds.

**Guarding Cars.**—In case the loading is temporarily stopped, he should see that the freight cars are securely locked or placed under suitable guard. Upon the completion of loading he should likewise see that freight cars are securely locked or kept under suitable guard until sealed by the railroad authorities.

**Organization to Load and Unload.**—At the proper time loading is begun and is carried on by the troops, pursuant to the orders of the commander. Heavy property may be loaded by details before the arrival of the troops (F.S.R. 393). Where the organization takes its property with it on the same train or other conveyance, the property is only constructively turned over to the shipping quartermaster. The organization commander or organization quartermaster supervises and checks the loading of it upon the cars, also supervises and checks the property from the cars at destination. The shipping quartermaster makes up the transportation requests and bills of lading from the data furnished to him on the shipping list or shipping invoices and the list of personnel.

**N. C. O. to be Assigned to Each Car.**—The kind and weight of all property loaded in each car must be shown. To accomplish this, when organizations take their property with them the com-



manding officer should assign a competent non-commissioned officer or enlisted man to each car with instructions to make a list of boxes, barrels, crates, bundles, and other packages, and the weight of each. Separate lists of property should be made for each organization, and the number of the car and the initials of the line to which it belongs must be shown on each list. The property is thus checked into the cars, and in the same manner it should be checked from them at destination, in each case the organization commander exercising such supervision as to insure that the checking is properly done.

Loading of Impedimenta.—The impedimenta, baggage, and rations should be so loaded that no difficulty will be had in unloading and separating them and distributing them to the proper owners. The same non-commissioned officers who superintend the loading should be assigned the same duty in unloading. All such property, except the light hand baggage of officers and blanket rolls of enlisted men, should be placed in the cars prior to entraining the troops, leaving nothing to go into the passenger coaches and sleepers except that which will be carried on the backs of the men and in the hand, so that as the troops are detrained the coaches will be left entirely free of any form of impedimenta and can at once be taken away by the railroad company. The property and baggage of each company will be stored separately as far as possible. Every article of baggage and property should be plainly marked or labeled. It is not practicable to furnish checks for this class of property. The travel rations for the journey, unless distributed to the troops, should be placed in an open-end baggage or freight car, next the loading coach.

Loading Vehicles Set Up.—The most suitable car for loading vehicles, shipped on their own wheels, of all kinds (except motor vehicles), including Artillery, Engineer, and Signal Corps organizations, is the 36-foot, drop-end, gondola (coal) car. Where there are a large number of vehicles to load, the entire number of cars necessary can be placed at one time, coupled together, a ramp placed at the end of the strings of cars and the vehicles run on the end car and pushed to the other end of the line of cars until all are loaded. After the loading is completed 2 by 4 scantlings should be spiked to the floor, outside of the wheels, to prevent lateral movements. Chocks, at least 3 inches high and of sufficient width, or suitable skids, should be spiked in place in front and in the rear of the wheels to prevent longitudinal movements. Five-inch spikes or 40-penny nails, should be used for the nailing. The drop-ends should be raised and secured. If drop-end gondolas cannot be secured the solid-end gondolas will *not* answer the purpose, but an equal number of 36-foot flat cars should be substituted in lieu of the drop-end gondolas. These should be loaded as outlined above, and, after loading is completed, should be chocked and blocked as described above. A further precaution may be taken to prevent shifting by using

gunny sacks, doubling them twice, and passing over the felloe next the floor and spiking down on each side.

**Loading Motor Vehicles.**—Automobile cars should be provided, if possible, but whenever impracticable to obtain them motor vehicles may be loaded on flat cars or coal cars from which one end has been removed. The best type of automobile car is similar to a furniture car, with a large door at each end. Others are provided with an extra-wide door at side. When not loaded in box cars they will be securely fastened, to prevent shifting of position, and may be properly protected by paulins. All loose and detachable articles must be placed in strong boxes and securely attached to vehicles or floor of car. Water tanks on vehicles operated by gasoline or naphtha will be emptied when shipments are made during freezing weather. Gasoline tanks will be emptied, and batteries of electrically propelled vehicles discharged, before shipment.

**Disposition of Bills of Lading.**—In order to prevent delay in delivering the bills of lading to the last carrier at destination, they should be handed to the train quartermaster, who should not fail to properly accomplish and deliver them to the railroad agent at the point of destination, except that, where there is an established quartermaster at destination, the bills of lading will be turned over to the latter for accomplishment, together with a statement by the train quartermaster that all property has been received in good condition, or, if there is any shortage or damage, with a statement of articles damaged, cause of damage, and the money value.

**Entraining Troops.**—The commanding officer of the troops should detail an officer as entraining officer, to proceed to the point of entraining in advance of the arrival of the command, to arrange assignment of the cars to the command. The quartermaster should cause all cars to be marked with chalk, designating the organization to occupy each, and the number of men for each car. These marks should be placed on the side of the car near the steps. He will furnish each organization with a written memorandum, showing the number of the train, number any kind of cars, the direction headed, the point where located on the tracks, the point for entraining, and the hour for entraining and dispatch.

The troops should be marched to the entraining point not more than 15 minutes before the time fixed for the departure of the train.

If necessary, a guard will be established in the vicinity of the point of entraining, the necessity of which will be determined, under direction of the commanding officer by the staff officer sent to reconnoiter the route. If a guard is required about the approaches, it will precede the troops, and as soon as the latter are entrained it will quickly follow.

The entraining officer will, as the command approaches, indi-

cate to each company commander the car or cars he is to occupy, and the company commander will march his command directly aboard, using but one end of the car when he is to occupy the entire car or a part thereof. The men in the lead should be directed to proceed at once to their places in the car, so as not to block the aisles.

Water Supply.—The men as soon as entrained will at once be cautioned in the economical use of water, as few cars are equipped to furnish more than a meager supply. A supplementary supply should be provided by arranging with the railroad company to place a galvanized-iron water can filled with water on the platform of each coach. Such provision should be made a part of the agreement. To conserve the supply the commanding officer should place a guard at each water tank, or barrel, to see that none is wasted.

Commander of Troops Sole Intermediary.—The commander is the sole intermediary between the troops and the railroad personnel. In case of deficiencies and other matters requiring correction, he addressed himself to officials in charge only (F.S.R. 396).

Action in Case of Delay En Route.—The commanding officer of each train section, if there is any unusual delay en route, should first take up the matter with the conductor or special agent aboard; but if the delay still continues after a reasonable time has elapsed, he should communicate by wire with the division superintendent of the railroad company advising him of the delay and requesting prompt action as to forwarding.

Should See that No Excess Accommodations are Used.—He should bear in mind that the contract, or agreement, with the railroad company is the basis for payment for the accommodations furnished; and, in so far as military passengers aboard are concerned, he should therefore see that no seats, berths, or other accommodations in excess of those authorized by regulations or provided for in the contract or agreement are used when it can be avoided. He should keep data regarding such delays en route and other matters as compel his command to unavoidably use the railway equipment beyond the scheduled time for arrival, including a reasonable time for detraining and unloading.

Unloading in Emergencies.—On account of accidents, freight blockades, or action of the enemy it may be necessary to unload in the open country. In such cases portable or improvised ramps will have to be used. Lacking these the train may be stopped in a low cut and crossties, baled hay, car doors, and turf utilized for the rapid construction of ramps of sufficient height to permit unloading of animals (F.S.R. 402, 1914).

Detraining and Unloading.—The train schedule is arranged, when practicable, for arrival at destination by daylight. The troops are notified in time to prepare for detraining. The officers and guard are first to leave cars. The commander meets



the staff officer sent to the train to deliver the instructions of the local commander, gets his bearing, and orders the troops to detrain. As soon as the passenger coaches or sleeping cars are empty the quartermaster, or a specially designated officer, accompanied by the conductor or other railroad representatives, makes an inspection of the cars and notes their condition; the result is reported to the commander. The troops procure their field kits and march to camp without delay, leaving suitable details to unload and bring up the property. If the camp is distant, arms are stacked and a part of all of the command unloads the train.

## B. TRANSPORTATION OF TROOPS BY TRUCKS

Trucks have proved of considerable value in the transportation of troops in this present war.

Combined troop and freight carrying automobiles are being provided and form part of the Army Automobile Convoy. Their tonnage is about  $3\frac{1}{2}$  tons. The bed is very large and the side curtains have celluloid windows. Each will carry 15 to 20 fully equipped Infantry soldiers. They are equipped with pneumatic tires on double wheels for quick movement. They are excellent for bringing up reinforcements.

The following notes on the transportation of troops by the French Automobile Service will be enlightening:

Actually, the Automobile Service has the special equipment necessary to transport large troop units. We create to this end a formation which we call a Groupment, which includes 6 groups. This Groupment has a Commander at its head and three Officer Assistants each of whom has a well-defined function.

The Assistant "Orienteur" arranges the column and keeps informed of the points of embarkation and debarkation.

The Assistant "Commissaire de routes" indicates the route and posts signs or lanterns at all important cross-roads, so that no one need miss the road.

The Assistant "Serre-file general" collects all the trucks that are broken down, forwards the troops that are in the same, and sends the vehicles back to the Repair Center.

While the Groupment under its Commander is more or less self-operating, there are nevertheless duties in the work for the General Staff Officer. General Staff Officers are necessary for the following reasons, viz.:

1. They must be at the point of embarkation to settle conflicts in authority between local railroad officers, troop commanders and the automobile service officers.

2. They must arrange for the local police of the route to be followed, for otherwise, if the column be stopped, you would



very soon have 12 kilometers of trucks all mixed up and confused on the road.

The importance of this particular phase has been demonstrated more than once, and it is only the General Staff Officer, speaking in the name of the Commander, that can arrange this property and promptly.

After numerous trials, the best manner to embark a considerable number of troops has been found to be the following:

a) Have a number of what might be called railroad side tracks where the trucks are in column, in much the same way as our railway trains in railway yards. If necessary, use a number of roads for this purpose. Arrange them at time of embarkation in such manner that automobile groups will pass on to the main road at intervals between each group of approximately one-half hour. You gain nothing in time by moving out in a single column.

b) March each battalion of troops in columns of 4 up to a group. (A group transports a battalion.)

The Commander of the Group has consulted with the Battalion Commander and he divides each company as it comes up to the Automobile Section Chief. (A Section transports a company.) The Company marches up, still in columns of 4, opposite the automobile section. The Company is then cut up for each truck load. The packs of the men are loaded in the rear of the trucks and the men embarked. The Assistant Chauffeur of each truck helps the Section Commander in this work.

Battalions arriving on time should be loaded and the Group should be moved out within twenty minutes after the arrival of the troops. A Group in movement covers a road space of two kilometers. We have seen that we should have a considerable interval between Groups, so as to prevent "backing and filling."

A Groupment, it follows, of 6 Groups (a Groupment transports a Brigade) will therefore occupy a road space of twenty kilometers. Its time in passing a given point would therefore be two hours.

Often the point of embarkation has not been definitely fixed beforehand, and here some difficulty may arise between the Automobile Service Officer and the Troop Commander. It is therefore, always advisable to have a General Staff Officer at a determined point to give the necessary orders.

Actually we have, as independent Groupments of the Army Automobile Service, two Groupments called the Reserve Regaudias, which are capable of moving the entire infantry of a Division in one load.

In addition, we have the Groupment Collot of six Groups of auto busses, which is at the disposition of the General-in-Chief.

Finally, there exists the Groupment Kom, which is actually at the disposition of General Foch. (Note.—At the time this paper was written General Foch was commanding the French troops

on the western end of the line.) It is probable that shortly two other Groupments will be created.

These reserve transportations have been formed principally with vehicles especially adapted for the work of transporting personnel.

The Reserve Regaudias is entirely formed of the American "White" automobile, which is very light, and has a 2-ton capacity.

For the reason given before, it is inefficient to use a 3-ton truck to transport 18 to 20 men. A solution of this difficulty is now being worked out, whereby we hope to be able to use a trailer and thus carry 34 men instead of 18. If this works out, one Group will be able to carry two instead of one battalion.

It was with a good deal of hesitation that the General-in-Chief, at the beginning of the war, authorized the transport of troops by automobile. Now he has changed his ideas, and to date we transport about 500 battalions per month. It therefore goes without saying that the use of trucks for this work is very important.

For a movement under 25 kilometers, there is really less fatigue for the troops to march the distance than to march to the point of embarkation and from the point of debarkation. In this case, however, the truck will help, for it can go and get the infantry packs, follow a different route and turn them over to the troops at destination. A Group will carry the packs of the entire Division.

We will now consider the cost of troop movements in trucks. Take, for example, a Brigade movement, of 40 kilometers with a 20 kilometers movement to the point of embarkation or, in other words, a complete trip of 100 kilometers. This costs:

$$100 \times .80 \text{ fcs.} \times 480 = 38,400 \text{ francs.}$$

It is, therefore, hardly economical.

## Part 5

### TRANSPORTATION OF HEAVY ARTILLERY BY TRUCKS

*(As worked out in the French Service.)*

The transportation of Heavy Artillery is a question which arose seriously in June, 1915. A number of tests had been made before, during the retreat in August, 1914, and later on in the First Army. It was not, however, until June, 1915, that the question was seriously considered. The results of the studies made on August 10, 1915, led to this means of transportation as a definite project.

There are two methods for transporting heavy artillery; one, to pull the piece; the other, to carry it in one or two loads. Both have their advantages and disadvantages. It is naturally

easier to pull the gun than to load it on the truck, but the pulling of the gun on the road behind a truck results in considerable wear and tear on the piece. To reduce the latter, trucks pulling pieces do not go faster than from 7 to 8 kilometers per hour, and a great deal of care is taken to prevent injury to the recoil apparatus of the gun by collision, etc. Carrying the gun has the great advantage of permitting the truck to make from 10 to 15 kilometers speed. You should not, however, draw any definite conclusions from the above facts, for you must differentiate between these methods of movement and the movement of what we call Heavy Tractor Artillery.

The latter artillery which is actually formed in regiments and groups includes all the necessary tractors and trucks for its complete unit and for the first supply of ammunition. The tractors of the group are all of the 4-wheel driven type instead of the 2-rear wheel driven, as is the case with all our other tractors. The 4-wheel driven, however, does not answer all purposes, for even for their use a good road is required, and a careful preliminary reconnaissance must be made of the route. They also cost about double the price of a 2-wheel driven.

The Artillery I have just referred to is the Tractor Heavy Artillery of which you all know. On the other hand, we are interested particularly in this paper in only the movement of such artillery as is not equipped with its own transport and what we call batteries of position.

It is necessary that artillery positions be mobilized. I do not mean by this that they can be quickly moved, but that they may be moved from one position to a new one in one or two nights. Now what is required for this movement? We will take, for example, two Sections. If you have 4 Groups you can transport 8 batteries. If this movement is 15 kilometers, the time required is 5 hours, and thus, if everything is carefully thought out, you can move 16 batteries in one night. You must note that in addition to the batteries themselves you have also transported the normal ammunition supply and the personnel with the Group of trucks referred to.

If the road reconnaissance has been well carried out you can transport the batteries near their position. 220-mm. cannons have been brought up during the night in the Champagne within 400 meters of the trenches without being discovered by the enemy.

You can see by the foregoing that by utilizing 4 or 5 Groups in an Army you can in one night change the position of 20 heavy batteries. It is, however, a procedure that must be tested and well drilled beforehand. The loading and unloading of the 155-mm. and large pieces requires the use of a pair of shears to lift the tube of the cannon on and off the truck and mount.



## CHAPTER II

### COMPOSITION AND ORGANIZATION OF A SUPPLY TRAIN

#### Part 1

#### COMPOSITION

The Supply Train is commanded by a Major, whose immediate superior in camp is the Commander of Division Trains, and in the field the Division Quartermaster. Its function does not extend to the transportation of ammunition, and it therefore must be borne in mind as distinct from the Ammunition Train. The Division Trains, including Ammunition Train, Supply Train, Engineer Train, and Sanitary Train, and the Military Police have a regimental organization under a Colonel, the Commander of Trains.

The regulations regarding the control, organization, and detail of officers for the division trains are covered by the following extract from G. O. 149, War Dept., Nov. 28, 1917:

#### REGULATIONS REGARDING DETAIL OF OFFICERS FOR DUTY WITH DIVISION TRAINS

IV. The following regulations regarding the detail of officers for duty with divisions trains are published for the information and guidance of all concerned:

1. Except when gathered together on the march or during an interval between marches under the commander of trains, as described in paragraph 280, Field Service Regulations, trains will operate under the direction of the following officers:

The Ammunition Train under the Chief of Artillery.

The Supply Train under the Chief Quartermaster.

The Sanitary Train under the Chief Surgeon.

The Engineer Train under the Chief Engineer.

2. In the National Army and National Guard division commanders will detail for duty with headquarters and military police and ammunition and supply trains such officers as are suitable for the detail, no matter in what arm or corps of the Army these officers may be commissioned. Officers so detailed are extra officers in the arm or corps in which commissioned. Engineer officers will be assigned to the engineer trains and medical officers to sanitary trains, except that supply officers for sanitary trains shall be detailed as prescribed above for the headquarters and military police and ammunition and supply trains.

3. In the Regular Army line officers are detailed to the divisional train service under Section 3 of the Act of Congress



approved June 3, 1916, by the Adjutant General of the Army from officers of the various arms and corps according to the equalization principle, which governs the detail of line officers to the various staff, corps and departments, as authorized in Sections 26 and 27 of the Act of Congress approved February 2, 1901.

4. Officers regularly detailed for duty with trains as prescribed in paragraphs 2 and 3 shall, while so detailed be carried as officers of the train service.

5. Enlisted men assigned to trains will wear the collar ornament prescribed in Uniform Specifications for trains and hat-cords as follows:

Headquarters and military police in an Infantry Division, infantry hat-cord; in a Cavalry Division, cavalry hat-cord; Ammunition Train, artillery hat-cord; Supply Train, quartermaster hat-cord; Engineer Train, engineer hat-cord; Sanitary Train, medical hat-cord.

6. Division commanders, in detailing officers for duty with trains, will be guided by the general principles enunciated in the following extracts from the Field Service Regulations, 1914:

280. **COMMANDER OF TRAINS.**—A commander of trains is assigned for each division, together with the necessary assistants and troops. He controls the marching and camping of the combined ammunition, supply, sanitary and engineer trains. He is also charged with all matters of general police in the rear of the division while on the march and throughout the command while it is in camp. (See Military Police.)

281. When the trains of more than one division are marching on the same road the Field Army Commander or other superior authority designates an officer, usually a General Staff Officer, to decide all questions of precedence in the movement and camping of the trains of the different divisions.

282. When combat is imminent the ammunition, sanitary, and engineer trains are ordered released from the control of the commander of trains, and thereafter during the period of the combat operate in the manner described hereafter. (See Ammunition, Sanitary Service, and Engineer Trains.)

Upon the completion of the period of combat and when no longer required to operate independently, these trains revert to the control of the commander of trains.

309. The Quartermaster in charge of the Supply Train is the subordinate of the commander of trains and operates his train as directed by the latter authority. He is responsible for the efficient operation of the Supply Train and commands its personnel.

314. The organization and operation of the ammunition service is the duty of the Field Artillery. The commander of the Ammunition Train is the immediate subordinate of the divisional

artillery commander after the ammunition train has been released from the control of the commander of trains.

339. The Sanitary Train.—The sanitary train is composed of ambulance companies, field hospital companies, and camp infirmaries. The sanitary train is commanded by the division surgeon, or in his absence, by the senior medical officer of the attached elements, who, upon its release from the control of the commander of trains, operated in accordance with orders or instructions received from division headquarters. (See F.S.R. No. 3.)

355. The organization and operation of the engineer train is the duty of the engineer corps. The engineer train is commanded by the senior engineer officer present with it, who, upon its release from the control of the commander of trains, operates it in accordance with the instructions of the senior engineer officer of the division. (322,052, A. G. O.) See Table 26.

Under this organization, two men should be assigned to each truck permanently, a corporal as chauffeur and a private 1st-class or private as assistant chauffeur. The entire personnel of the companies should be taught to operate and care for a truck.

The unit of Motor Truck Transportation, it is obvious, is the motor truck company, six of which, with the headquarters company, make up a Supply Train. In the succeeding pages frequent mention will be made of a motor truck company which will be understood to be a Supply Train Motor Truck Company. With the preceding data from this chapter thoroughly understood as a basis, to understand the organization and operation of a motor truck company, is to understand the same for the Supply Train as a whole.

The present equipment of a motor truck company is thirty-one trucks: 27 ordinary cargo trucks, 1 baggage, ration, and spare parts truck, 1 kitchen truck (trailer type), 1 or 2 gasoline refilling trucks, and 1 light repair truck. There is also a passenger car (roadster type) and a motor cycle with side car attachment.

The Company is normally organized into three sections of nine trucks, each section under command of an assistant truckmaster. The service trucks are kept under the immediate orders of the truckmaster, these not forming an integral part of the cargo sections. When the company is not operated as a train, these trucks may be assigned to cargo work, and in such case, should be attached to sections.

All trucks, except tank trucks, are normally equipped with war bodies, as it is desirable to have only standard bodies with a truck company. The baggage and ration truck is an ordinary cargo truck, and the repair truck, a cargo truck equipped with removable chests, benches, etc., for tools and parts. The gasoline carrying trucks, when part of the equipment, are cargo trucks with special channels in beds for carrying metal gasoline drums. The three ton body is equipped to carry ten gasoline

drums, giving a capacity of 550 gallons; the one and one-half ton body carries four gasoline drums, giving a capacity of 220 gallons.

The Motor Cycle should be standardized and permit of side-car attachment. It should have interchangeable wheels and single-cylinder, air-cooled, detachable engine. Belt drive is preferable. The side-car frame should be standardized to permit machine gun, stretcher, passenger seat box, or other fixture to be attached.

The Light Car should be standardized and be able to carry two men and 500 pounds of freight over the most difficult roads. It should have a clearance of 10 inches, equal sized, interchangeable disk wheels, solid rear axle, two-wheeled trailers, and abolition of the differential. Wheels of car and trailer to be interchangeable. The greatest advantage of this kind of car is that its failure to reach its destination means the loss of but 500 pounds of freight, while the loss of a large truck from a shell would mean several tons of freight destroyed.

## Part 2

### GENERAL ORGANIZATION OF A MOTOR TRUCK COMPANY

The commander of a motor truck company has a problem which may be grouped into two general classes, administrative and mechanical.

The administration of a truck company is identical with that of a company, troop or battery. The Company Commander is responsible for the discipline, operation, and supply of his command. He is assisted by the truckmaster, whose duties are analogous to those of a 1st Sergeant. The truckmaster is the executive, and sees that all orders or instructions are properly carried out.

Each assistant truckmaster is responsible for the discipline of the men of his section, and for the proper operation and upkeep of the equipment assigned thereto. All orders or instructions to various members of a section should be given to the assistant truckmaster in charge thereof and he should be held rigidly accountable for the condition and operation of his section. The truckmaster, and assistants, must understand their authority and responsibilities and must be required to exercise both. The company commander must utilize his time in directing and supervising the general work, and unless he requires his subordinates to do their proper share of details, he will have no success in perfecting his organization.

In each company, the division of responsibility with reference to operation, repair and upkeep of the mechanical equipment should be established by the company commander and published

in a company order, so that each member of the company shall be thoroughly familiar therewith.

The general practice is to make each truck driver responsible for the operation, repair and upkeep of the truck and equipment, as well as all other property, assigned him. The extent of the repairs that he should be required to make depends much on the ability of the personnel. In general, however, this will extend to what are classified as minor repairs, not requiring a more extensive mechanical knowledge than is possessed by the ordinary chauffeur. Work on the motor and ignition system is under the direct supervision and orders of the chief mechanic. Aside from this, it is better to determine the proficiency of the individual driver or chief of section, before letting any repair, except the most simple, be performed by them. Beware of the work done by "amateur experts."

The trucks of each section are under the direct supervision of the Chief of Section, who is held responsible for their upkeep and repairs. Likewise, the Chief Mechanic, assisted by other mechanics, has general supervision over the mechanism of the truck equipment, as well as the detailed repair work devolving on them.





## CHAPTER III

### THE ADMINISTRATION OF A MOTOR TRUCK COMPANY

With the Duties of Officers and Non-Commissioned Officers

#### Part 1

#### DUTIES OF COMPANY COMMANDER

(See Q. M. Manual 3287)

He is responsible for everything connected with the operation and maintenance of his company. He should bear constantly in mind that his company is a transport organ, in the service of the United States, and in making all decisions on a course of action he should realize that his mission is determined by that fact. In addition to seeing that all members of his command properly perform their duties, the following points are noted that call for special attention on his part.

(A) Prevent speeding of trucks. Speeding is destructive to trucks' mechanism and it is a practise very difficult to prevent, and extremely conducive to accident, and markedly destructive to discipline. Punish all violations with heavy hand. Trucks are built for strength, not speed.

(B) See that all motor governors are properly regulated, in accordance to specific requirements as to motor speed laid down in the book of directions issued by the truck manufacturer. Seal these governors and keep the sealing tool in your personal possession. Allow no seal to be broken without your express authority and severely punish any man who tampers with the seal. This practice of opening up governors is a common one, and very hard to stop. But it is very destructive to motors by permitting them to run at excessive speed.

(C) Keep accurate check on gasoline and lubricating supplies. It is a great practice to use gasoline for many other things except fuel, and there is a great temptation to dispose of the same unlawfully. The gasoline supply should be under the immediate supervision of a designated man, who should make careful record of all issues. Check warehouse or quartermaster's receipt against record of issue of this man, as well as record of consumption as taken from drivers reports. Be careful in the minute details of proper handling, and you will not be troubled by the larger details. This care of property extends to all equipment. Take individual checks of the equipment at frequent intervals, to assure not only that your equipment is complete, but also detect carelessness or theft. Remember that automobile and motor parts are high priced and extremely sal-

able, and if some of your men realize that your supervision is lax, they will sell your trucks from under your nose.

(D) Do not allow a cut-out to be used, and keep mufflers repaired and in working order at all times. The cut-out gives less than one per cent more power. The noise made when the cut-out is open, or muffler not properly working is a nuisance to everybody, and in addition, the exhaust of gases striking the roadway direct raises excessive clouds of dust. This is another practice with chauffeurs, which must be severely punished in order to stop.

(E) Do not allow motors to run while trucks are at rest longer than a period of one minute. This is common practice and hard to stop. Drivers object to the sometimes difficult work of cranking the motor, and will avoid doing it whenever possible. This practice in addition to wasting gasoline, may lead to a serious result when company is operating in field service.

(F) Always remember that your motto should be "Service First." Don't lose sight of the mission of your company by getting too much interested in the working of the trucks' mechanism.

(G) Details of the upkeep and repair of truck mechanism will be found in instruction books issued by manufacturers. The publication will be studied carefully and ample number of copies always kept on hand in the company for reference. The book will give full details with diagrams of all parts of the truck mechanism. It is written by the maker of the truck, and forms the most authoritative set of instructions thereto. It is incumbent on the company commander to be thoroughly familiar with principles of the mechanism of the truck, and to see that the enlisted personnel is properly instructed concerning them, and that they are properly enforced. In order to assure this, it is necessary to make periodical inspections of all parts of the mechanism, as well as other equipment.

The company commander will be rigidly checked up in this respect, for General Orders of the War Department (G. O., 139, 1917) require division commanders to see that regulations for motor transportation are rigidly followed out by all units of this branch of the service within the division. The order reads in part:

"While it is not intended to restrict the control of commanding officers or subordinate tactical units over the vehicles assigned to them for military purposes, it is considered necessary for their preservation and continuance in service to exercise a central control over the mechanical operation and adjustment of all machines and to provide regular inspection of the condition of these vehicles. Except in cases of evident military emergency, automobiles and motor trucks will never be loaded to more than their rated capacity. Motorcycles with side cars will not be subjected to

a greater load than 500 pounds, and no part of the load will be attached to the frame of the motorcycle or side car except that two rifles may be carried in boots secured to the handlebars and front forks of the motorcycle. The commanding officer of each organization to which motor transportation is assigned will be held responsible for the prevention of the use of these vehicles for purposes other than the performance of military duty."

## Part 2

### DUTIES OF THE TRUCKMASTER

1. The duties of the truckmaster, are to see that all chauffeurs, cyclists, or other employees are thoroughly instructed in their duties and are competent to perform all the duties developing upon them in connection with the motor company. And under the company commander, has immediate charge of all work, operation, and matters of discipline and administration pertaining to the company.

2. He will see that all noncommissioned officers know and properly perform their duties, and will habitually give his orders to each section through his section leader. And will be responsible for the appearance of the vehicles under his charge.

3. His duties are analogous to those of a First Sergeant, and all communications to the company commander should go through him.

4. He will require chauffeurs or cyclists to maintain supervision over the care of the vehicles and property, including the loads, and will hold them strictly responsible therefor.

5. He will be the truck dispatcher and will know at all times the number of trucks in the park, out of work, and laid up.

6. The truckmaster will report every evening to the Company Commander for instructions for the next day's travel and will have the company ready promptly at the specified time.

7. Should a chauffeur or cyclist desire a leave of absence, he should be required to make his application through his truckmaster and assistant truckmaster, giving his name, position and necessity for leave. And in the First Sergeant's absence his duties fall to the senior truckmaster present, or to the non-commissioned officer in charge of quarters in the absence of the assistant truckmasters.

8. He is the First Sergeant and executive of the company and should be addressed and referred to as the First Sergeant. He shall report all violations, and neglect of duty to his Company Commander.

9. He should be a man chosen for his administration and executive ability, his efficiency in handling men and for his mechanical knowledge. The chief mechanic may well be chosen for his ability as a mechanic, irrespective of his ability to han-



dling men. But the First Sergeant should be a man of force, as his prime duty is to maintain proper discipline for the efficient operation of the company.

Part 3

DUTIES OF ASSISTANT TRUCKMASTERS

1. The assistant truckmasters are assistants of the First Sergeant in all matters pertaining to the company. Each assistant truckmaster is responsible for the discipline and all instructions, and all other matters pertaining to his section; for operation, repair and upkeep of the equipment assigned thereto.
2. Trucks requiring the attention of a mechanic will be laid off work and a report will be made to the First Sergeant.
3. The assistant truckmaster when on detached service with a section of trucks will be responsible for, and perform all the duties ordinarily required of, the truckmaster.
4. He is the intermediary between the men of his company or section and the truckmaster or Company Commander. His supervision extends to all the details connected with his section, including police and sanitation of tents, seeing that men are properly equipped with necessary articles, including clothing, etc. All orders for his section, either for the personnel or equipment, should be given to him.
5. He should examine all trucks on return from work and see that drivers have made thorough inspection, taken proper care of same and that proper repairs are made, making a record of all repair parts used. He will see that upon the return of a truck from work it is in good condition for a maximum trip, filled with oil, gasoline, etc. However, if arrival at camp is late at night inspection and repairs may be deferred until morning. If repairs needed are such that they cannot be easily made in the time available, the fact will be reported to the company commander, who will issue orders to cover the case.
6. He should assure himself that his section is in proper condition at all times, by making regular and systematic inspection of his men and equipment at stated periods, which should be at least every ten days, and a report made on form similar to that shown below. These inspections should be checked frequently by the company commander. In his absence, for any cause, an acting Chief of Section should be designated to perform his duties.

CO. "A," 301ST SUPPLY TRAIN

Inspection Report

Inspected by .....

Car number .....

Date .....

Total registered miles .....

**Engine**

|                           |                               |
|---------------------------|-------------------------------|
| Condition found .....     | Condition left .....          |
| Oil pan cleaned .....     | Valve tappet adjustment ..... |
| Oil screen cleaned .....  | Noise .....                   |
| Oil gauge registers ..... | Nuts and bolts .....          |
| Oil leaks .....           | Bolts to frame .....          |
| Governors oiled .....     | Compression .....             |

**Fuel and Carburetor Systems**

|                        |                         |
|------------------------|-------------------------|
| Connections .....      | Float chamber .....     |
| Idling condition ..... | Carburetor action ..... |
| Pressure system .....  | Pressure gauge .....    |

**Ignition Systems**

|                              |                        |
|------------------------------|------------------------|
| Batteries: Test Sp. Gr. .... | Magneto .....          |
| Wiring .....                 | Mag. Lubrication ..... |
| Spark lever action .....     | Spark plugs .....      |

**Cooling System**

|                      |                   |
|----------------------|-------------------|
| Radiator .....       | Connections ..... |
| Gaskets .....        | Couplings .....   |
| Packing glands ..... | Fan .....         |
| Pump Action .....    | Fan Belt .....    |

**Clutch**

|                    |                      |
|--------------------|----------------------|
| Engagement .....   | Thrust bearing ..... |
| Brake action ..... | Lubrication .....    |

**Gear Set, Driving Shaft and Differential**

|                 |                        |
|-----------------|------------------------|
| Control .....   | Bolts on frame .....   |
| Noisy .....     | Universal joints ..... |
| Oil leaks ..... | Lubrication .....      |

**Control System**

|                   |                       |
|-------------------|-----------------------|
| Lost motion ..... | Service brake .....   |
| Foot pedals ..... | Emergency brake ..... |

**Running Gear and Frame**

|                          |                         |
|--------------------------|-------------------------|
| Condition of tires ..... | Wheel alignment .....   |
| Wheels .....             | Grease boots .....      |
| Springs .....            | Steering gear .....     |
| Spring hangers .....     | Chain adjusted .....    |
| Spring shackles .....    | Distance rods .....     |
| Rivets loose .....       | Radius rods .....       |
| Lubrication .....        | Nuts all cottered ..... |

Lighting System

|                                   |                  |
|-----------------------------------|------------------|
| Working order .....               | Side lights..... |
| Headlights .....                  | Tail lights..... |
| Presto-lite tank, condition ..... |                  |

Body

|                          |                |
|--------------------------|----------------|
| U. Bolts .....           | Sides .....    |
| Bed .....                | Tailgate ..... |
| Bows .....               | Cover .....    |
| Tool kit, complete ..... |                |
| Equipment complete ..... |                |

Part 4

DUTIES OF THE CHIEF MECHANIC AND HIS ASSISTANTS

1. The Chief Mechanic is assisted by two assistant mechanics, and is responsible directly to the truckmaster. He is generally responsible for the making of proper repairs of the company.
2. He is in charge of the repair truck and tools and equipment pertaining thereto, and will keep a record of all spare parts and supplies issued and the cost thereof. He should sign for tools and equipment and issue it to assistant mechanics for proper receipt. He should be held responsible that his equipment is properly kept up, and that any shortages, by damages, loss, etc., are properly made up.
3. He should see that the assistant mechanics are properly qualified and should instruct them in their work.
4. It shall be the duty of the mechanic, assisted by the chauffeurs, to make all repairs and important adjustments of parts on all vehicles in his company while on the road. He will be held responsible for the examination of the physical condition of all vehicles and will be required to keep an accurate record, showing at all times the exact condition of all parts of each vehicle in his company. He shall also keep a record of all repairs made to vehicles. This record shall describe in detail each particular repair, the condition of part and vehicle after each repair period, the time necessary to make repairs, and the total length of time the vehicle was out of service, from time defect was observed until the time the vehicle was again placed in service.
5. The mechanic will report to the truckmaster at the end of each day's work the particular supplies and parts that were used during the day, and also a complete list of all supplies and parts needed to fill the list of stock to be kept on hand.
6. The mechanic shall also keep the truckmaster informed

regarding the condition of all vehicles in his company and the estimated time required to finish the necessary repairs to each disabled or defective vehicle, and will recommend vehicles to be turned into the shop for repairs when their state of repair is beyond the facilities accompanying the company.

7. He shall promptly report any accident to an assistant truckmaster or truckmaster, giving complete details as to the cause of accident and estimated time, material and parts necessary to make repairs and place vehicle in serviceable condition.

8. It shall also be the duty of the mechanic to give assistance in the packing or loading of vehicles, or any other duty assigned him, when his services are not required in connection with the repair or adjustment of vehicles.

9. While travelling he shall keep watch on all vehicles in the company and shall report any vehicle that needs attention, and also will call the attention of chauffeurs or cyclists to any condition affecting the operation of the vehicle, such as lubrication, minor adjustments, repairs or improper loading, and he shall also report such conditions to the assistant truckmaster. To enable him to ascertain the condition of the vehicle (Cars or trucks) he should make a practice of riding on each vehicle in succession.

10. It shall also be the duty of the mechanic to inspect the wheels, axles, spindles and steering gear connections and maintain same in proper adjustment and alignment in order to prevent undue wear on the tires.

11. It shall be the duty of the mechanic to carefully study and become familiar with the book of instructions issued by the manufacturer of the vehicles which he has in charge, and must become thoroughly familiar with all detail of construction and all instructions in reference to the proper care of the vehicles, except those that are required to be performed by the chauffeur in accordance with these regulations.

12. All valves should be carefully examined and thoroughly ground to a gas-tight at least once in every three months. Care must be taken that not the least particle of grinding compound remains in the cylinders or clearance space after the grinding has been completed.

13. It shall be the duty of the mechanic to do all the cleaning and adjusting of all gears connected with the vehicle. The adjustment of gears should not be attempted by the chauffeurs.

14. After every 1,000 miles of travel of the truck or motor car, remove each wheel, both front and rear. Remove all grease and clean all bearings, spindles, shafts, rollers or balls, and inside hubs with kerosene and repack hubs and bearings with clean grease. Replace wheels and properly adjust bearings. Care must be taken that bearings are not adjusted too tightly, but still not loose enough to permit slapping of the wheels.



15. Tools should be coated with oil to prevent rusting and then should be securely locked up.

### Part 5

## DUTIES OF THE COMPANY CLERK

1. He has charge of all records, reports and correspondence of the company. He will notify members of the company as to orders and instructions received, and call upon them for prescribed reports. Other duties are prescribed by the company commander according to local conditions. He will check up all tools at least once a month. Record time trucks are laid up for repairs.

### Part 6

## DUTIES OF THE MESS SERGEANT

1. He has direct charge of the mess hall, kitchen, and all dealings pertaining thereto, including supervision of the cooks or other men working therein. He draws rations, sees that kitchen, mess hall, and premises are properly cared for. He makes up the daily bill of fare, noting thereon all articles used from the store-room, and the cost thereof, thus keeping track of the daily savings or shortage on the mess. He keeps up the Daily Mess Statement, which is an accurate account of stock on hand, and its value, and of daily purchases. His authority to contract debts or expend money should be carefully watched and checked by company commander personally. The company commander should also check up the ration return and Form 223 in regard to matches, soap, and toilet paper. The soap allowance is 0.64 ounces per ration or 4 lbs. to 100 rations. The toilet paper allowance is 1000 sheets for each 60 rations. The match allowance for lighting fires is as many as the commanding officer deems necessary. The flour allowance for paste to be used in target practice is 50 lbs. per company each season.

## MESSING

(See Manual for Army Cooks, 1917)

**Essentials for Good Mess.**—The first essential to a good organization being a good mess serving bounteous, well cooked and wholesome food, company commanders will give their personal attention to the rationing and messing of their organizations. While the Mess Sergeant should be allowed considerable latitude, he should at the same time be required to constantly advise with his company commander as to the best means of maintaining a first-class mess. It frequently happens that the Mess Sergeant fails to allow for the changes in the number of men he feeds during the month and bases his expenditures on his ration allowance computed by the Quartermaster from

his last ration return. For this reason, the mess should be run on a daily cash basis, computed from the strength of the organization present each day as shown by the morning report.

**Mess Records.**—(a) The Mess Sergeant will prepare all bills of fare and submit them to the company commander for approval. The bill of fare should be figured one day ahead, and in doing this the ingredients to be used in the various dishes for each meal should be set down on a memorandum pad, and an accurate record of the value of articles used kept.

(b) He also submits to the company commander a daily statement showing the exact financial condition of the mess. This statement includes receipts from all sources from the first of the month, the credit with the Quartermaster, value of stock on hand, the allowance from the company fund, if any, and a detailed report of the expenditures.

(c) A balance will be daily struck which clearly shows whether the stock on hand, the credit with the Quartermaster and the unexpended cash are sufficient for running the mess for the number of days remaining in the ration period.

(d) The organization commander will give particular attention to the beef and flour components which, taken together, amount to more than one-half the value of the ration. Beef, especially, is the foundation of the ration, and carelessness in handling of this component will soon put an organization in debt while, by careful selection of such low-priced meats as liver, beef hearts, sausage, together with high-priced meats as pork, fish, chicken etc., an average price will result which will secure a satisfactory variety while keeping within the limits of the ration.

**Expensive Foods.**—The mistake is often made of purchasing expensive varieties of food when cheaper ones will answer the purpose just as well. The plain, substantial, standard food materials are as digestible and nourishing as more expensive articles.

**Perishable Foods.**—Food that is liable to deteriorate should not be purchased in large quantities. In purchasing perishable articles, such as green onions, lettuce, etc., a supply for only one meal should be bought.

**Serving Meals.**—A meal, however well prepared must be properly served to give satisfaction and to prevent unnecessary waste. This requires a system by which everything is brought on the table hot or cold, as intended. The table must be set with care and kept scrupulously clean. Good order in the dining room and proper conduct at the table are directly influenced by the care with which arrangements are made for the reception of the men.

**Cleanliness.**—Scrupulous cleanliness will always be observed in handling and serving the food. Cleanliness consists not only in the personal cleanliness of cooks and kitchen police, but also in the cleanliness of the kitchen, kitchen equipment and cooking utensils. This cleanliness will not be maintained by the organization itself and consequently becomes a direct duty of the company commander. The prevention of waste and the proper use of left-over food is the secret of success in company kitchens. It should be regarded as a breach of discipline for a man to leave a plate of unconsumed food, and service should be so regulated that immediate report is made to the company commander of such an incident.

**Flies.**—Constant and unceasing effort must be made to rid the mess halls and kitchens of flies. At least ten fly swatters should be purchased from the company fund and a detail made before each meal to swat flies. In addition, cooks should be required to burn out flies by the use of waste paper, torches, etc., this to be done in early morning while flies are still sluggish and cold.

**Cooking on the March.**—On the march there is little time in the morning for the preparation of breakfast and no attempt should be made to have a great variety of food. A few components, good and substantial, including plenty of hot coffee, should be provided.

Upon arrival in camp, it is necessary to provide a quick meal as the men are usually tired and hungry. It is an excellent practice to provide an improvised fireless cooker, by which means a hot meal can be quickly served. While the organization is making camp and attending to the necessary camp details, the cooks have ample time to prepare the main meal of the day, which is usually served late in the afternoon. For this reason, the kitchen car should lead the train.

## Part 7

### DUTIES OF THE CHAUFFEUR

(A) It shall be the duty of the chauffeur to carefully study and become familiar with the manufacturer's book of instructions of the vehicle which he is operating, and he must become thoroughly familiar with all details of construction and must carefully carry out all instructions in reference to the proper care and operation of the vehicle, except those which are required to be performed by the mechanic, in accordance with these regulations.

(B) The chauffeur shall assist in the loading and unloading of the truck and shall direct the placing and distribution of the load on the truck. He shall be held accountable for the proper loading and transportation of all material or supplies of which the load may consist. Inattention to the loads or permitting any part of same to fall off the truck will be considered



cause for disciplinary action. Before vehicles are parked for the night the gasoline, cooling water, cylinder oil, gear oil, and gear grease must be completely replenished and the entire truck carefully examined. If darkness intervenes, the filling of gasoline tank will be done in the darkness or electric lights will be used. All minor repairs or adjustments which are found necessary will be completed at once by the chauffeur, and the entire vehicle again carefully examined the following morning. All important repairs or adjustments which are found necessary and which must be done by the mechanic, shall be reported at the time the vehicles are parked, to the assistant truckmaster who is in charge of his section. The chauffeur shall assist the mechanic in all repairs and adjustments to his truck. He keeps his truck and its equipment clean and in proper repair and working order. In order to do this, he utilizes his spare time while not on duty and does not wait until his truck reaches the park to do all the minor work required thereon. He should be especially cautioned to attend to the proper lubrication of all parts of truck mechanism, and to promptly report any defects noted or repair needed. In transporting supplies, he will see that the truck is not overloaded except on the direct order of a commissioned officer. Should the truck be overloaded, he will report the circumstances to the truckmaster at once. He will also make a report of the distance traveled with each load and the distance his truck ran with no load, also the total mileage for each day. He will make a record of the amounts and kinds of supplies at the time they are used, of all washings and polishings and general cleanings of all parts of the vehicle, the complete lubrication of all parts of the engine, the filling of grease cups, and the replenishing of all oil and grease in working parts, cleaning, trimming wicks, and filling of oil lamps, the examination every day of both service and emergency brakes, the filling of storage battery with distilled water and the testing of solution with battery hydrometer, the care and repair of spark plugs, the draining of water and dirt from settling chambers of strainers in gasoline tank or gasoline pipe line.

(C) The chauffeur should be required to wear proper uniform and be properly dressed when driving. He should be required to carry with him at all times a suit of fatigue clothes and avoid excessive clothing issues.

(D) The recording of the total mileage travelled daily.

(E) The recording of the amount in gallons of gasoline consumed each day, and the recording of the amounts and kinds of other supplies at the time they are used.

(F) The reporting of all defects which cannot readily be repaired by the chauffeur himself.

(G) The washing, polishing, and general cleaning of all parts of the vehicle.

(H) The complete lubrication of all working parts, including



the proper lubrication of all parts of the engine, the filling of grease cups, and the replenishing of oil or grease in all gears or bearings.

(I) Cleaning, trimming wicks, and filling of oil lamps.

(J) The examination, every day, of both service and emergency brakes.

(K) The filling of storage battery with distilled water, and the testing of solution with battery hydrometer.

(L) The care and repair of spark plugs.

(M) The draining of water and dirt from settling chambers or strainers in gasoline tank or gasoline pipe line.

(N) Keep all parts of vehicles clean. Dirt contains grit which cuts bearings and all moving parts. Mere external washing or hosing will not do. Dirt must be removed, scraped off if necessary.

(O) Lubrication is by far the most important detail pertaining to the care and operation of the vehicles and must be diligently attended to. Without lubrication, disastrous results are sure to follow, and the chauffeurs will be held strictly responsible for such neglect of duty.

(P) It shall be the duty of the chauffeur to provide for the complete lubrication of the transmission and differential, at all times. A good quality of gear oil should be added to both the transmission case and differential case, at least every 500 miles. At least every 2,000 miles, the oil should be completely drained from the transmission case and differential case, the case and parts thoroughly cleaned with kerosene, permitting the kerosene to finally drain completely from the case, and the case replenished with a fresh supply of gear oil. The gear oil should at all times be maintained at the proper level in the transmission case and differential case.

(Q) All grease cups should be given attention daily. Each cup should be screwed down until grease begins to enter bearings, and the cup refilled if the grease has become exhausted.

(R) The oil reservoir in crank case of engine should be refilled with cylinder oil each day and adequate means taken to insure that the oil is at the proper level.

(S) Once a month the engine should be cleaned by draining all lubricating oil from the crank-case and oil pipes, the plug replaced, the crank-case connections and oil-pump flushed with kerosene, and after turning the engine over a few times by hand, the kerosene should be thoroughly drained from the engine, the drain-plug replaced and the crank-case replenished with a fresh supply of cylinder oil. At the time the engine crank-case is being cleaned with kerosene a couple of ounces of kerosene should be placed in each cylinder through the priming cups, and the engine turned over a few times by hand. Also the oil pump should be carefully cleaned and all dirt, lint,

or sediment removed from the screen at the oilpump. Care should be taken that no lint, waste or other foreign matter be permitted to enter the crank-case or oil connections after they have been cleaned.

(T) Once a week a few tablespoonfuls of kerosene should be injected through the carburetor intake pipe while the engine is running and thoroughly hot, in order to assist in the removal of carbon. After the injection of kerosene, the engine should be permitted to run until the smoke due to the injection of kerosene has entirely disappeared.

(U) The radiator, water-jackets of engine, water pumps and connections, should be completely drained of water at frequent intervals; the radiator, jackets, and circulating pipe thoroughly cleaned by flushing with clean water, which should be permitted to drain out and the cooling system should then be filled with a fresh supply of clean water. Care must be taken that no foreign matter is permitted to enter the cooling system with the water. The fan-belt should be examined at frequent intervals, making sure that the belt is not too tight. The belt should be sufficiently loose to permit it to slip to a small extent when the engine is running at high speed or is accelerating rapidly and suddenly.

(V) The radiator and cooling system should always be completely filled with clean water. The amount of water in the cooling system should be determined morning and evening and during the day's run if considered advisable. If the radiator at any time becomes overheated, the reason for such a condition should at once be determined and the difficulty immediately corrected, or reported to the assistant truck-master as soon as practicable.

(W) In winter, freezing of the water in the cooling system should be prevented by the use of denatured or wood alcohol. Sufficient alcohol should be used in the cooling system to prevent freezing under the lowest temperature conditions. The amount of alcohol necessary to prevent freezing at different temperatures is given below.

| Alcohol by<br>volume. | Freezing<br>Temperature | Alcohol by<br>volume. | Freezing<br>Temperature |
|-----------------------|-------------------------|-----------------------|-------------------------|
| Per cent.             | Degrees F.              | Per cent.             | Degrees F.              |
| 10                    | 25                      |                       |                         |
| 20                    | 13                      | 40                    | —20                     |
| 30                    | —2                      | 47                    | —30                     |
| 35                    | —12                     | 55                    | —40                     |

(X) The alcohol referred to in the above table is 95% denatured alcohol or 95% wood alcohol.

(Y) The use of calcium chloride or any alkaline solution, or any patented anti-freezing solution is prohibited.

(Z) Additional alcohol should be put in the cooling system at such times as required, as may be determined by the frequent use of the freeze meter, which will be part of the equipment of each truck and motor car.

(A.B.) The motor truck chauffeur shall at all times drive the truck at the proper maximum speed, to prevent undue wear and vibration of the truck. The chauffeur must exercise proper judgment as to the maximum allowable speed under different conditions, the speed depending on the load and the condition of the roads. The speed of the truck shall at no time be faster than the maximum rate of speed recommended by the manufacturers.

### Recapitulation of work to be done daily

Fill gasoline tank, straining gasoline through a closely woven cloth. The use of a chamois for straining is prohibited, because of the danger of generating static electricity and exploding the gasoline. Always stop the engine and extinguish all lights, before filling the tank.

Fill the oil reservoir and make sure that the oil guage is indicating the proper level.

Fill the radiator with clean water, taking care that no foreign substances enter with the water and clog the tubes.

Fill, clean, and trim oil lamps, using kerosene.

Inspect the vehicle carefully, and test all important nuts and bolts by tightening with a wrench. Make note of all squeaky or rattling parts, tightening on nuts, and lubricating various parts until squeaks and rattling noises are eliminated.

Examine tires at the end of the day's work for defects or damage, and again in the morning before entering on the day's work.

The chauffeur will be held responsible for the cleanliness of the motor and the brass work.

All chauffeurs will report to the truckmaster, or the designated assistant, at the end of the day's work, that the above duty has been performed.

All chauffeurs will report to the assistant truckmaster one hour before starting time.

## Part 8

### DUTIES OF NON-COMMISSIONED OFFICERS IN CHARGE OF PROPERTY

There is no supply sergeant allowed in a Supply Train Motor Truck Company according to the latest tables of organization, but the large amount of property which such a company has, in addition to the regular issue of quartermaster and ordnance



property to individuals, makes it imperative that a reliable non-commissioned officer be detailed for the duties of a supply sergeant. He is habitually known as the non-commissioned officer in charge of property.

He is responsible for all supplies and equipment not actually issued to individuals, equipment and supplies except subsistence, and will keep necessary reports and return of same. He is however, responsible that all issued property is properly receipted for by the persons responsible. He keeps the store room clean and in proper order and should have a list up to date of all property and disposition of same. All dealings with the Quartermaster or Supply Officer, not requiring the personal intervention of the Company Commander, should be carried on by him.

Spare parts will be issued to the sergeant mechanic only, and an accurate record will be kept of such issue.

## Part 9

### DUTIES OF THE MESSENGER

The messenger is at the immediate service of the company commander, to perform such duties as his name implies. He habitually drives the company commander's car. He carries a set of signal flags, and must be proficient in both Semaphore and Wig-Wag signalling.

## Part 10

### DUTIES OF THE MEMBERS OF THE HEAD-QUARTERS COMPANY

The duties of the supply officer are those of a supply officer for the whole train. He is accountable for all property of the train, including that of the truck companies. He will issue property to the company commanders on memorandum receipt. On request of company commanders he prepares proper requisitions for property, parts, accessories, stores, and rations. He will ordinarily ride in the touring car with the commanding officer.

The duties of the adjutant are no different from those of any battalion or regimental adjutant. He will ordinarily ride in the touring car with the commanding officer.

Of the two quartermaster sergeants, one will act as chief clerk and sergeant major, administrative; the other will be property sergeant. They will ordinarily ride on the truck.

The sergeant, first class, will be clerk and stenographer for supply train headquarters.

The two sergeants are expert typewriter repairmen, for duty as directed by the division quartermaster.

One corporal chauffeur will be assigned to the touring car,



another to the baggage and ration truck, and a third will act as a statistical clerk.

The cook is the steward of the train officers' mess.

The private, 1st class, will be assigned to drive the motorcycle, will act as messenger and orderly, and perform such other duties as the commanding officer may prescribe.

The privates act as relief drivers and such other duties as may be prescribed. Two especially may be detailed to assist the property sergeant as needed. One will assist the cook in charge of the officers' mess. The privates will usually ride on the truck.

## CHAPTER IV

### RECORDS AND BLANK FORMS

(A.R. No. 280 and 281)

The records of a truck company pertain to personnel, property and operation:

**Personnel Records.**—These are the same as those for a troop, battery, or company.

**Property Records.**—Each company keeps its own property account, which includes an ordnance and a Quartermaster return.

**Truck Operation Records.**—These include reports of operation of truck companies, cost reports and reports of change or condition of motor material.

**Miscellaneous Records.**—In addition to the above, the records and publications shown in Table 7, Part II should be procured and kept by each truck company.

#### Part 1

#### Records of Personnel

The attention of Company Commander is directed to the imperative necessity each is under of giving personal attention to securing absolute accuracy and completeness in all:

- (a) Entries on service records.
- (b) Entries on muster and pay rolls.
- (c) Entries of clothing, requisition, issued and charged to signatures, initials and correct charges.
- (d) Entries of sizes of all items of clothing, particularly shoes, the fitting of all items to be done under the personal supervision of said officers.

In order to facilitate the handling of official communications bearing on the subjects of furloughs, transfers, discharges and changes of name, the following is published for strict compliance by all concerned:

#### Furloughs

The applicant should state:

- (a) Date furlough is to take effect.
- (b) Reason for desiring furlough.
- (c) Point where applicant desires to go.
- (d) Statement of service.
- (e) Furloughs, if any, during present and immediately preceding enlistment period, giving dates.

The endorsement of the Company Commander should state:

- (a) Approval or disapproval.
- (b) Full name of soldier.
- (c) Whether the statements of the applicant are correct.
- (d) If he has sufficient funds to defray his expenses, including return to his station.
- (e) Character of applicant.
- (f) Number of enlisted men on furlough from organization including pending applications.
- (g) Enlisted strength of organization.
- (h) Whether applicant is on special duty, and, if so, its nature.
- (i) Whether the applicant is indebted to the U. S.

### Promotions

Applications for promotion will be submitted in triplicate to the Department Commander through Military Channels, the original copy being prepared in the handwriting of the applicant. Applicant should state:

- (a) Date and place of birth.
- (b) Present grade.
- (c) Educational advantages.
- (d) Whether single or married.
- (e) A statement of his enlistments and re-enlistments.
- (f) Whether he has ever been a non-commissioned officer. If so, details of grade, time, and organization in which held.
- (g) A statement of his experience in the position sought.
- (h) Whether ever reduced in grade, or court-martialed: if so, details.

The certificate of a medical officer showing whether the applicant is physically suited to perform the duties incident to the position sought, will be enclosed.

The indorsement of the Company Commander will state:

- (a) Approval or disapproval.
- (b) Whether the statements of the applicant are correct.
- (c) General remarks for fitness for position sought.

### Transfers

The applicant should state:

- (a) Organization and station to which he desires transfer.
- (b) Reason for desiring transfer, which must be good and sufficient.
- (c) Complete statement of service, including date of current enlistment and character on discharges from prior enlistments.

(d) Conjugal condition.

(e) That he has the necessary funds and is willing to defray the expenses involved, if transfer is granted.

The indorsement of the Company Commander should state:

(a) Approval or disapproval.

(b) Full name of soldier.

(c) Whether the statements of the applicant are correct.

(d) Character of applicant.

(e) Whether the applicant is indebted to the United States.

(f) Physical condition.

(g) Whether applicant has sufficient funds to defray expenses of transfer.

(h) Court martial record; if reduced during current enlistment, give reason.

(i) Strength of organization.

In all cases application for transfer from one organization to another within the department will be submitted to all commanding officers concerned before being forwarded to headquarters for final action.

## DISCHARGE ON ACCOUNT OF DEPENDENT RELATIVES

Applications for discharge on account of dependent relatives must originate with the soldier himself and contain the following information:

(a) Reason for desiring discharge.

(b) Post Office address of dependent relatives, including street and number of house.

(c) Statement of Service.

(d) Statement of accounts.

(e) Conjugal condition. If married, documentary evidence of such marriage, giving date of same.

(f) An affidavit from one or more relatives of soldier, and similar affidavits from at least two persons not relatives, giving information as to reasons why soldier should be discharged from the service.

The indorsement of the Company Commander should state:

(a) Approval or disapproval.

(b) Full name of soldier.

(c) Whether the statements of the soldier are correct.

(d) Character of applicant.

(e) Remarks.



Before forwarding requests of this nature, organization commanders should investigate the statements submitted with the application, by correspondence with the recruiting officer at or near the place of residence of dependent relatives, if there be one in that vicinity: if not, the postmaster at the place should be interrogated as to the condition alleged and the report of such investigation forwarded with application.

**Name, Change of.**—Before requests for change of name will receive consideration by the War Department, the applicant will be required to submit his sworn statement prepared and signed by him in his present name, setting forth his alleged correct name and the circumstances under which he enlisted under the assumed name. He should also submit the duly executed affidavits of his parents or other near relatives with respect to his correct name, and the affidavit of at least two persons, not relatives of the soldier, to the same effect. If there is a public record, either birth or baptismal, showing his correct name, a certified copy of, or transcript from, that record should be obtained and forwarded.

**Service Record.**—(Form No. 29 A.G.O.) will be prepared in the case of each member of the company, whether enlisted or civilian. On this S/R will be entered all data necessary for a complete record. The same care will be exercised in keeping this record complete for civilian employees as for enlisted men. This record follows a man whenever he is transferred. Blank Spaces must be initialed as provided in Instruction 12 on Service Record. See Cir. 12 W. D. 1910, as to erasures; G. O. W. D. 1915, as to typhoid immunization; G. O. 30 W. D. 1914, as to vaccination.

The following exceptions to instructions on the Service Record apply in its preparation with reference to men inducted into the National Army.

(a) The form for Report of Assignment in the service record, will be detached and destroyed in all cases in which the assignment is reported on the Enlistment and Assignment Card, and the words "Assignment reported on enlistment and assignment card" will be noted on stub of Report of Assignment in lieu of the date of mailing report.

(b) When assignment is reported on the form for Report of Assignment in the service record, the line "Who was accepted for enlistment at ....." will be stricken out.

(c) The line "Accepted for enlistment at ....." on page 3 of the service record, will be stricken out as it is not applicable to enlistment in the National Army.

(d) If the soldier reported for military duty on the date and at the place specified in the notice from the local board, the words "Reported same date and place" will be entered on page 3

of service record immediately below the "Enlisted ....., 191., at ....." Otherwise, the date and place of reporting will be stated.

**Monthly Returns.**—(Forms Nos. 30 A. G. O. and 434 Q.M.C.) A.R. 811 and 812.—1st day of each month.

**Muster Rolls.**—(Forms Nos. 61-61a A.G.O.) Instructions on the form to be strictly complied with. A.R. 807.—Every two months start about 27 or 28th of month and complete on the last day.

**Record of Service.**—(Form No. 174 Q.M.C.) For companies with civilian personnel.

**Records of Court Martial.**—(Form No. 594 A.G.O.)

**Morning Reports.**—(Form No. 332 A.G.O.) To be in by 7.30 each morning.

**Sick Reports.**—(Form No. 339 A.G.O.) To be completed and signed by 4.15 P.M. Daily.

**Duty Rosters.**—(Form No. 342 A.G.O.)

**Pay Rolls.**—(Forms Nos. 366-366a W.D., Q.M.C.) for enlisted companies. (Form No. 334-334a Q.M.C. will be used for civilian personnel). Rolls to be prepared in triplicate, one copy being retained for record. G.O. 40 W.D. 1916.—To be completed on last day of each month.

Information for Allotment of Pay and Application for Family Allowance, Form 1B, Bureau of War Risk Insurance, to be made for each soldier upon assignment.

Application for insurance. (Form 2 A, Bureau of War Risk Insurance, for men in the service Oct. 6, 1917, before Feb. 12, 1918. Others within 120 days after enlistment.)

Qualification Record Cards. To be made out for each soldier on assignment. (Yellow copy retained, White copy forwarded at enlistment.)

Y. M. C. A. Data Cards. To be made for each soldier on assignment. (One copy retained, Two copies forwarded at enlistment.)

**Correspondence Book** to be supplemented by a document file and to be kept as indicated by instructions contained therein. See Bulletin 4 W.D. 1914; also Quartermaster Manual, per 290.

**Blank Discharges and Final Statements.**—(See A.R. No. 150.)

**Records, Files and Orders, etc.,** to be permanently retained. (See A.R. Nos. 280 and 281.)



## Part 2

## RECORDS OF PROPERTY

The Supply Officer must account for all property received on loose leaf sheets (**Form 599 A. G. O.**),—"Property Return," and there must be a voucher filed against each entry. Account to be kept and mailed to various chiefs of bureaus in accordance with Par. 681-B, A. R. Articles of clothing and individual mess equipment, after they have been issued to the enlisted men, do not have to be accounted for by the Supply Officer unless returned to him when a man is separated from the service, or by company commanders as surplus or unserviceable, and not exchanged for other articles. (Par. 681-P, A. R.)

A record of all property in the personal possession of the members of the organization will be kept on **Form 637, A. G. O.** Binders for this form and those of similar size can be obtained on Requisition Form 160.

For all clothing and equipment required by individual enlisted men, a single **individual clothing slip (Form 165, Q. M. C.)** will be made out, in accordance with provisions of Pars. 1157 and 1163, A. R.

Clothing may be issued to the enlisted men on individual clothing slips, or on **bulk requisitions (Form 213, Q. M. C.)** made out by the company commander. Procedure to be followed in the former case is indicated in Pars. 1158-1160, A. R.; in the latter, in Pars. 1161-1163. In the former case it will be necessary to keep an **abstract of clothing** issued on **Form 180, Q. M. C.**

Equipment other than clothing is issued on **Requisition Form 160, Q. M. C.** Company commanders sign **Memorandum Receipt** for same on **Form 448, A. G. O.**

For securing replenishment of equipment, see Par. 681-F, A. R. **Statement of Charges, Form 602, A. G. O.**, will be authority to obtain equipment to replace any which has been lost or damaged by enlisted men.

When property except clothing and individual mess equipment is transferred out of a company with a man, they will be invoiced to the man's new commanding officer on **Form 600, A. G. O. (Transfer of Property)**, and accounts will be adjusted, all in accordance with the provisions of Par. 681-O, A. R. When such equipment is turned in to the Supply Officer, company commanders will invoice it in duplicate to him on **Form 600, A. G. O.**, and receive from the latter credit slip on **Form 448, A. G. O.** (Pars. 681-P and 1165, A. R.).

For **Surveys** see Pars. 710-726, A. R. **Form 196, A. G. O.**, "**Report of Survey**," used in this connection.



**Vouchers.**—For all purchases and employment of services other than personal made a voucher must be put in on Public Form 330, carbon copy kept in company files on Q.M.C. Form 217A, "Voucher to Post Property Account;" same to be turned in semi-annually to Quartermaster General of the Army.

The following certificate will appear on the face of each requisition for replenishment of Equipment "C":

"I certify that the articles called for hereon, together with the amount on hand, are necessary to furnish this organization with the allowance prescribed for Equipment 'C' in Table of Fundamental Allowances, 1917, and that no articles in excess of this allowance are called for on this requisition."

**Ordnance Return.**—A return of ordnance property will be rendered to the Chief of Ordnance, Washington, D. C., on June 30th, and December 31st of each year.

### Company Council Book

A record of all receipts and disbursements pertaining to the company, to be supported by vouchers in accordance with printed instructions therewith. (Form No. 452 Q.M.C.). See A.R. 327, 328 and 323.

All income derived from company barber shop, tailor shop, shoe repair shop, laundry, billiard or pool tables, or any other sources must be duly accounted for in the company fund book.

Decisions of the War Department authorize the expenditure of the company fund for the following articles: Blank passes, rubber stamps, clothing lists, typewriters, printing presses and printing (band fund), enamel ware, aprons for cooks, detachment messes, furniture for recreation rooms, attendant for pool tables, company barber, troop wagon, garden seed and auto truck of cheaper grades.

The expenditure from company fund for the following articles is not authorized: Bull's eye score books, rifle prizes, Moss-Dalton Records, business facilities, coats and trousers for cooks, lard compound, messes for married men, extra pay for company cooks, room orderly, lavatory orderly, purchase of beer or any intoxicants.

The sale of surplus fuel, oil or forage is strictly prohibited.

Upon the dissolution of a truck company, the company fund remaining on hand will, under the decision of the Inspector General of the Army, be turned over to the company funds of other motor truck companies, as may best subserve the interests of the Government. In this connection, the funds of the motor truck companies should be so managed as to avoid accumulations of large balances, in which case legitimate expenditures may be so arranged as to leave no balance in the fund when the company is dissolved. (C. of M. for M.T.G. No. 2 November 16, 1917.)

## Part 3

## RECORDS OF OPERATION AND MAINTENANCE

1. A record will be kept in each company of all motor-driven vehicles assigned, this record to contain the following data:

Name of truck or vehicle.

Model, year and carrying capacity.

Manufacturer's No.; Chassis No.; U. S. No. and motor No.

Magneto make and number.

Carburetor,—Make, Model and number.

Battery, make and number.

Presto-lite Tank No.

When and from whom received.

Time in service when received.

Condition when received.

Make, No. and type of tires, size of tires, whether dual or single, and condition of tires when received.

Initial cost and cost of operation and repairs to date.

Changes to be posted immediately, and this record being kept to date at all times.

2. Each driver will turn in a daily Truck Report showing total accumulated mileage at start and finish; the mileage for the day; tons hauled; gasoline and oils used; etc. Books for these blank reports will be furnished by the Quartermaster.

(Form)

DRIVERS DAILY TRUCK REPORT

Mileage..... Start..... Mileage Finish.....

| Trip No. | From | Lv. | To | Ar. | Miles | Pounds | Ton | Ton Miles |
|----------|------|-----|----|-----|-------|--------|-----|-----------|
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |
|          |      |     |    |     |       |        |     |           |

TOTALS.....

| SUPPLIES      |       | On Hand | Rec'd | Total | Used | Balance |
|---------------|-------|---------|-------|-------|------|---------|
| Gasoline      | Gals. |         |       |       |      |         |
| Oil, heavy    | Qts.  |         |       |       |      |         |
| Oil, light    | "     |         |       |       |      |         |
| Oil           | "     |         |       |       |      |         |
| Grease, cup   | "     |         |       |       |      |         |
| Grease, Trans | "     |         |       |       |      |         |
| Grease        | "     |         |       |       |      |         |
| .....         |       |         |       |       |      |         |
| .....         |       |         |       |       |      |         |
| .....         |       |         |       |       |      |         |
| .....         |       |         |       |       |      |         |
| .....         |       |         |       |       |      |         |

Repairs Required.....

Driver .....

Remarks .....

Date .....191..

O.K.'d By.....

Truck Co.....

Co. No.....

Example of Above Report Filled Out:

### CO. "A," 301ST SUPPLY TRAIN

#### DRIVER'S DAILY TRUCK REPORT

| Trip No.    | From          | Lv.    | To               | Ar.   | Miles | Pounds | Tons | Ton Miles |
|-------------|---------------|--------|------------------|-------|-------|--------|------|-----------|
| 1           | Park .....    | 7 A.M. | Storehouse ....  | 7.15  | .50   | M.T.   |      |           |
| 2           | Storehouse .. | 7.15   | Coal Pocket....  | 7.30  | .50   | M.T.   |      |           |
| 3           | Coal Pile ... | 8      | Base Hospital..  | 8.30  | 3     | 6,000  | 3    |           |
| 4           | Base Hosp...  | 9      | Storehouse ....  | 9.30  | 3     | M.T.   |      |           |
| 5           | Storehouse .. | 10     | 301 Infantry     |       |       |        |      |           |
|             |               |        | Co. "B".....     | 10.20 | 2     | 6,000  | 3    |           |
| 6           | 301 Infantry. | 11     | Storehouse ....  | 11.20 | 2     | M.T.   |      |           |
| 7           | Storehouse .. | 11.45  | Park .....       | 11.55 | .50   | M.T.   |      |           |
| 8           | Park .....    | 1 P.M. | Storehouse ....  | 1.15  | .50   | M.T.   |      |           |
| 9           | Storehouse .. | 1.50   | 301-2-3 Inf... } | 2.15  | 6     | 6,000  | 3    |           |
|             |               |        | 301-2-3 Art... } |       |       |        |      |           |
| 10          | 203 Art.....  | 5      | Storehouse ....  | 5.20  | .50   | M.T.   |      |           |
| 11          | Storehouse .. | 5.30   | Park .....       | 5.40  | .50   | M.T.   |      |           |
| Totals..... |               |        |                  |       | 19    | 18,000 | 9    |           |

| Supplies                  | On Hand  | Rec'd | Total  | Used | Bal'nce |
|---------------------------|----------|-------|--------|------|---------|
| Gasoline .....            | Gals. 30 | 15    | 45     | 15   | 30      |
| Oil, Heavy.....           | Qts. 13  | 3     | 16     | 3    | 13      |
| Oil, Light.....           | "        |       |        |      |         |
| Oil .....                 | "        |       |        |      |         |
| Grease, Cup.....          | "        |       |        |      |         |
| Grease, Trans.....        | "        |       |        |      |         |
| Odometer A.M.—2,063 Miles | 1 Pt.    |       | Grease | oil  |         |
| " P.M.—2,082 "            |          |       |        |      |         |
| 19 Miles                  |          |       |        |      |         |

Repairs Required: Lights not working—Brakes will not hold.

Remarks: Hit 301 Inf. mule team near Y.M.C.A. No. 25. No damage to either vehicles.

Driver, Sergt. W. Brown

Date, Jan. 2, 1917.

Truck No. 12

Truck Co. No. 4.



3. All orders for trucks, except regular details of the depot quartermaster (which are received in typewritten form), are entered on the daily blotter, which is the following form:

Form 1

DAILY REPORT OF MOTOR TRUCK DISPATCHER

.....191..

| Order No. | How Rec'd | Rec'd by | Time Rec'd | Order Auth. by | Filled by Co. | No. of Trucks | Description of Order | Date of Advance Order |
|-----------|-----------|----------|------------|----------------|---------------|---------------|----------------------|-----------------------|
|           |           |          |            |                |               |               |                      |                       |

.....

Dispatcher

4. A board, with holes and pegs, according to the following, should be made for use of the truck dispatcher. It is self-explanatory, as the peg in one of the holes of the last three columns will give the desired information of the truck.

| Truck No. | Driver     | In | Out | Laid up |
|-----------|------------|----|-----|---------|
| 3101..... | Adams..... | 0  | ○   | 0       |
| 3102..... | Brown..... | ○  | 0   | 0       |
| 3103..... | Cody ..... | 0  | 0   | ○       |
| 3131..... | Yates..... | ○  | 0   | 0       |

A more complete form for the same purpose is the following<sup>4</sup>:

(Form 3)

DAILY RECORD OF OPERATION OF MOTOR TRUCKS

Motor Truck Co. .... (Date) .....191..

CO. 301ST SUPPLY TRAIN

Daily Record of Operation of Motor Trucks

Date .....19

| Truck No. | Driver | Time in | Time Order Received | Destination | Time |     | Remarks | Truck Report |
|-----------|--------|---------|---------------------|-------------|------|-----|---------|--------------|
|           |        |         |                     |             | In   | Out |         |              |
|           |        |         |                     |             |      |     |         |              |

In this way, accurate record can be kept of the whereabouts of each truck and the number available at any particular time.

5. The Truck Dispatcher will submit a daily report to organization headquarters showing the number of trucks on duty, and the number from each company not available for duty.—Form 4, hereunder.

(Form 4)

.....191..

| Truck Company | Number of Trucks in Company | Number of Repair and Gas Trucks | Number Trucks laid up for repair | Permanent Detail | Drivers not available | Trucks available | On Detached Service in camp | On Detached Service out of camp | REMARKS |
|---------------|-----------------------------|---------------------------------|----------------------------------|------------------|-----------------------|------------------|-----------------------------|---------------------------------|---------|
|               |                             |                                 |                                  |                  |                       |                  |                             |                                 |         |

.....  
Truck Dispatcher

.....  
Commander

The forms used by the Dispatcher are drawn up so as to absolutely fix responsibility for any failure of truck to properly report. The signature of person to whom truck is directed to report is designated to prevent a truck being taken by someone other than the person intended, a proceeding, very common.

6. The following is the most common order form for trucks in use. The copies are signed by the truckmaster or assistant, and one copy is retained in book. The remaining two copies are taken by the truckmaster, one for his own company record, the other for the driver of the truck, or man in charge of the groups of trucks responding to the order.

When the truck is sent out from the company, the driver or man in charge signs the copy retained by the company, and has his copy signed by the person to whom the trucks are ordered to report. He turns in this copy to his company on his return. The driver also reports to the dispatcher when returning from any duty terminating before 4.00 P.M.

Form 2  
ORDER FOR COMPANY

.....191..  
(Place) (Date)

No.....

Co. ....  
Send trucks to report as specified below :

No. of trucks.....

To whom to report.....

Place .....

Hour .....

Remarks .....

By direction: .....  
Dispatcher

Received above order: .....  
Hour..... (Asst) Truckmaster, Co.....

.....  
(Perforated)

Company.....

Truck No..... Hour of departure.....

Drivers ..... Hour of return.....

Signature of man in charge of truck.....

.....

Trucks reported to me as directed above

Time..... Signature.....

1. When automobile, motor trucks, or motor vehicles are transferred from one station to another with transfer of accountability, Q.M.C. Form 493, "Transfer of Motor Vehicle" (penalty post card), the transferring officer will fill in on the card all data called for thereon and mail to proper officer on the same day the motor vehicle is shipped or transferred. The operation cost to be entered represents total cost of same to date of transfer, including all operation cost since original purchase of the vehicle. When cost prior to date of receipt of motor vehicle is not of record in the office of the officer making the transfer, the cost of record will be entered, showing dates from and to which the cost reported applies, with notation that previous costs are not known; such information being obtained by receiving officer upon application to the Quartermaster Corps for statement of cost not reported.

### TRANSFER OF MOTOR VEHICLE

.....

....., 191..

Manufacturer .....

Style or model .....

Serial No. .... H. P. ....

Capacity ..... Cost, \$.....

Purchased ..... 191

By .....

At .....  
(Station)

### COST OF OPERATION TO DATE

Repairs to machine ..... \$.....

Repairs to tires ..... .....

Tires or tubes ..... .....

Other costs of operation ..... .....

.....

.....



8. A cost record will be kept for each vehicle. This can be done by using an ordinary blank book issued by the Quartermaster, necessary columns being ruled off. The cost of all repairs, the amount and cost of all gasoline, oils, grease, etc., wages of chauffeurs, number of days laid up for repairs, etc., in fact everything required to render an accurate and comprehensive report on Forms No. 416 and 417 Q.M.C.

COST RECORD

Truck No.....

| Miles Run |               |              |       | Cost of Operation          |                   |                     |                 | Supplies Used |                   |                    |                    | Tires |  |  |  |  |
|-----------|---------------|--------------|-------|----------------------------|-------------------|---------------------|-----------------|---------------|-------------------|--------------------|--------------------|-------|--|--|--|--|
| Date      | Truck Company | Truck Loaded | Total | Average Load Tons on Truck | Total Tons Hauled | Wages of Chauffeurs | Tires and Tubes | Repairs       | Gasoline, Gallons | Cup Grease, Pounds | Gear. Oil, Gallons | Tyre  |  |  |  |  |

The Cost Record should be supplemented by the use of a large book containing a page for each truck in the company, with an itemized record of all supplies bought for the truck, and spare parts used for the repair of same. The cost record gives only the figures; this book gives the details of the expense which each figure represents.

This report will be prepared in triplicate, at the end of each quarter, the original and one copy being rendered to the Department Quartermaster, the other copy retained with the company records.

“Ton-miles” is obtained by multiplying “tons” by “miles” for each trip where a load is carried, which converts the data into showing 1 ton hauled so many miles.

These reports should be forwarded not later than the fifth of the month following the end of the quarter.

The following is an example of Q.M.C. Form 416 filled out:

**CO. "A," 301ST SUPPLY TRAIN**  
**QUARTERLY REPORT OF MOTOR TRUCKS ON**  
**HAND AT CAMP DEVENS, MASS.**

For the Quarter Ended December 31st, 1917

| 1. Name of truck.....  | Kelly-Springfield | Kelly-Springfield | Kelly-Springfield |
|--|-------------------|-------------------|-------------------|
| 2. Model.....Year .....                                      | K-40-1916         | K-40-1916         | K-40-1916         |
| 3. Manufacturer's number.....                                | 30050             | 30050             | 30050             |
| 4. When received.....  | 6-13-17           | 6-13-17           | 6-13-17           |
| 5. From whom received.....                                   | C. O. Motor       | Group No          | gales, Ariz.      |
| 6. Time in service } Yrs. ....<br>when received. } Mos. .... | one               | one               | one               |
| 7. Conditions when received.....                             | Good              | Good              | Good              |
| 8. Miles run, total.....                                     | 332               | 350               | 347               |
| 9. Miles run, truck empty.....                               | 170               | 130               | 120               |
| 10. Miles run, truck loaded.....                             | 162               | 220               | 227               |
| 11. Average load, tons, on truck..                           | 1.68              | 2.75              | 2.80              |
| 12. Ton miles, multiply No. 10<br>by No. 11.....             | 272.16            | 605               | 635.60            |
| 13. Total tons hauled.....                                   | 101               | 112               | 110               |
| 14. Cost of operation. { Wages of chauffeur.....             |                   |                   |                   |
| 15. { Tires and tubes.....                                   |                   |                   |                   |
| 16. { Repairs .....  | \$125.00          | \$5.00            | \$14.50           |
| 17. { Gasoline .....   | \$41.08           | \$35.10           | \$37.82           |
| 18. { Oil and other material for<br>cleaning and operation.. | \$6.00            | \$2.00            | \$4.00            |
| 19. { Misc. cost—if any.....                                 |                   |                   |                   |
| 20. { Total cost.....  | \$172.08          | \$42.10           | \$56.32           |
| 21. Cost per ton per mile, divide<br>No. 20 by No. 12.....   | .063              | .07               | .08               |
| 22. Present condition.....                                   | Good              | Good              | Good              |
| 23. Qty. used. { Gasoline, gallons.....                      | 158               | 135               | 147               |
| 24. { Cup grease, pounds.....                                | 5                 | 5                 | 5                 |
| 25. { Gear oil, gallons.....                                 | 2 $\frac{3}{8}$   | 2                 | 2                 |
| 26. { Cylinder oil, gallons.....                             | 14 $\frac{1}{4}$  | 24 $\frac{1}{4}$  | 10                |
| 27. Tires. { Type .....                                      | Demountable       | Demountable       | Demountable       |
| 28. { Make .....   | Kelly-Springfield | Kelly-Springfield | Kelly-Springfield |
| 29. { Condition .....  | Good              | Good              | Good              |
| 30. Time laid up awaiting repairs                            | 10 days           | 1 Day             | 2 days            |

Remarks: Received from Capt. D. L. Beman, Q.M.R.C. Motor Truck Group, Nogales, Ariz., from reserve. Taken from reserve shop 6-13-17 and placed in active service 6-13-17, Reports for Oct., Nov., Dec., 1917.

....., Q. M. Corps.

Station, Camp Devens. Date, Dec. 31, 1917.

Q. M. C. Form 416.

Authorized April 23, 1913.

Revised March 15, 1916.

10. In order that information may at all times be available as to condition of Motor Transportation, all concerned will report by letter to headquarters on the twentieth of each month any material change in the condition of this means of transportation, giving U. S. and serial numbers. Should no change have occurred during the month, report to that effect will be made.

Should any trucks be detached from a company, the officer under whom such trucks are operating, on the last day of the quarter, or when the trucks are relieved from further duty under his charge, will furnish the commanding officer of the truck company to which they belong, such data as is necessary to enable the truck company commander to submit the required report for such trucks on Form No. 416.

Should any truck company be placed in reserve during any quarter, the required report on Form No. 416 will be submitted to these headquarters immediately upon its being placed in reserve. Should any company be placed in commission during any quarter, reports will be made at the end of the quarter for that portion of the quarter in which it was in operation.

Requisitions for spare parts for motor-propelled vehicles will bear on the FACE of the requisition a statement showing the NUMBER of EACH ARTICLE that is needed for IMMEDIATE REPAIRS and the number that is wanted for STOCK.

**11. Surveys.**—Articles lost, damaged or destroyed by carelessness or lack of proper care on the part of the individual to whom issued, or who is responsible therefor, will be charged to the individual on the pay roll. (See A.R. 682.)

For articles worn out through fair wear and tear, see A.R. 710.

12. Officers in command of truck companies are cautioned that proper care, supervision, and frequent inspection of articles of equipment is required of them. They are also held to a strict accountability for the proper care of all articles of equipment.

**13. Reports.**—Each truck company will turn in a daily report, by 4.30 P. M. to Truck Dispatcher, showing the number of trucks that will be available for duty the following day.

#### Part 4

### INSPECTOR GENERAL'S DEPARTMENT FORMS

No. 1, Inventory and Inspection Report of Public Property.

No. 1a, Inner sheets of Form 1.

Instructions regarding the rendition of the above forms will in most cases be found printed on the form.

They must contain a complete list of all unserviceable property to be condemned, for the use of the inspector when he appears. There are three columns, "To be kept in service," "To

be destroyed," and "To be sold," and after each item the inspector notes in the proper column what disposition is to be made of property in question.

### Part 5

## SUMMARY OF FORMS

### Daily

1. Morning report, to headquarters.
2. Sick report, to the surgeon.

### Last Day of Each Month

1. Pay rolls, three copies; one retained; two to the designated quartermaster through headquarters:

### First Day of Each Month

1. Form 410, Q. M. C.: Three copies; one retained; two to the department or division quartermaster.
2. Form 30, A. G. O.: Two copies; one retained; one to headquarters.
3. Form 434, Q. M. C.: Three copies; one retained; two to the department or division quartermaster.
4. Form 223, Q. M. C. (ration return): Two copies; one retained, one to headquarters. (Conditions may require this return to be submitted every ten days, on the 1st, 11th, and 21st of the month. On the march or similar work, this return is submitted as required.)

### Bi-monthly

1. Muster Rolls: Three copies; one retained; one to Adjutant General of the Army direct; one to the Quartermaster General through the department or division quartermaster.

### Quarterly

1. Form 416, Q. M. C.: Three copies; one retained; two to the department or division quartermaster.
2. Form 417, Q. M. C.: Three copies; same disposition as Form 416, Q. M. C.

### June 30 and December 31

1. Ordnance Return: Two copies; one retained; one to the Chief of Ordnance direct.
2. Property return Form 599 and Voucher to Post Property Account, Form 217A: Two copies; one retained; one to the Quartermaster General direct.



3. Form 407, Q. M. C. (June 30 only): Two copies; one retained, one to the Quartermaster General direct.

4. Form 461, Q. M. C. (December 31 only): Two copies; one retained; one to the Quartermaster direct.

Upon the transfer of a man to the company from any source other than the Quartermaster Corps, a copy of his service record (Form 29, A. G. O.), will be forwarded directly to the Quartermaster General's office (Sec. 5, paragraph 1009, A. R.).

The following records are required to be kept in a company:

1. Retained copies of all returns, reports, requisitions, etc., required to be submitted.

2. Correspondence book and document file.

3. Morning report (Form 332, A. G. O.).

4. Sick report (Form 339, A. G. O.).

5. Duty roster (Form 342, A. G. O.).

6. Service record of each man in the company (Form 29, A. G. O.).

7. Company council book (Form 452, Q. M. C.).

8. Record of sizes of clothing worn by each man.

9. Record of courts-martial (Form 594, A. G. O., to be filed with the soldier's service record).

10. Property returns (Form 599, A. G. O.).

11. Ordnance return (Form 18, Ordnance Department).

12. Individual property account (Form 637, A. G. O.)

13. Delinquency record (Form 509, Q. M. C., see paragraph 334, Manual for Courts-martial, 1917.)

## Part 6

### SUPPLY OF BLANK FORMS

#### Equipment "C"

The following is estimated as a three (3) months' supply of blank forms required for a motor truck company, to be carried in the field desk:

"A."—Supplied by the Adjutant General's Department  
Quantity Form

| Required. | No. | Description.   |
|-----------|-----|--|
| 6         | 17  | Certificate of Disability for Discharge, prepared only upon request of surgeons.     |
| 9         | 26  | Field Return (a retained copy to be kept).   |
| 6         | 29  | Service Records (read instructions carefully).                                       |
| 9         | 30  | Return of Company (with model). This report is rendered the first day of each month. |
| 6         | 34  | Inventory of effects of a deceased soldier.  |

| Quantity<br>Required. | Form<br>No. | Description.   |
|-----------------------|-------------|--|
| 9                     | 61          | Muster Rolls (in triplicate for motor truck company, the original to be sent to the Adjutant General, one copy sent through Dept. Q. M., the other to be retained as a permanent record of the company). Read carefully instructions on back of outer sheet.                                       |
| 27                    | 61a         | Extra sheets for muster roll.  |
| 6                     | 66          | Furlough.  |
| 6                     | 95          | Descriptive list of Deserter.  |
| 12                    | 196         | Report of Survey.  |
| 3                     | 332         | Morning Report (with model and instructions).  |
| 12                    | 336         | Officer's Pay Voucher.   |
| 6                     | 338         | Guard Report.  |
| 2                     | 339         | Daily sick report.   |
| 3                     | 342         | Duty Roster (with model).  |
| 3                     | 383         | Requisition for books and blanks furnished by the Adjutant General's Department.   |
| 6                     | 415         | Report of Death and disposal of remains.   |
| 12                    | 525         | Honorable Discharge form (see A. R. 148 as to the U. S. Army to use of blanks).  |
| 50                    | 448         | Memorandum Receipt. (Debit and Credit slip.)   |
|                       | 448b        | Memorandum Receipts, Abstract Record of.   |
| 12                    | 526         | Discharge from the U. S. (for discharge) Army.   |
| 6                     | 527         | Dishonorable Discharge from the U. S. Army.  |
| 36                    | 594         | Charge sheet for Court-Martial. Correspondence model, see Compilation General Orders, Bulletins, Circulars, etc.   |
| 1                     |             | Correspondence Book (to be supplemented by a correspondence document file as indicated by instructions in the book).   |
| 6                     | 599a        | Loose leaf binders.  |
| 500                   | 599         | Loose leaf forms in ledger style, kept in binders on which all transactions in ordnance property and Quartermaster property are recorded. A separate sheet is used for each article and all entries are supported by voucher, numbered, serially, from July 1st to June 30th, of each fiscal year. |
| 500                   | 599         | Carbon copies for above.   |
| 50                    | 602         | Statement of charges—for either Q.M., Ordnance, Signal or Engineer property.   |
| 150                   | 600         | Transfer of Q.M., Ord., Engr., or Signal property.   |
| 100                   | 637         | Individual Equipment Record.   |
| 200                   | 22-2        | Enlistment and Assignment Card.  |

The foregoing are supplied through the Adjutant's office.

**Read Carefully the Instructions on Each Blank  
"B."—Supplied by the Quartermaster Corps**

Quantity Form

Required. No.

Description.

|   |        |  |
|---|--------|--|
| 12  | 336WD  | Pay Roll (enlisted men).   |
| 48  | 336aWD | Pay Roll (enlisted men) follow sheet. To be made in triplicate, original and one copy forwarded to Quartermaster paying troops, other copy retained as record of the Company. Data for roll obtained from Service Records. |
| 12  | 370WD  | Final statement (instructions shown on form).  |
| 6   | 8aQMC  | Advice of soldiers' deposits.  |
| 1   | 38     | Soldiers allotment blank (book form).  |
| 12  | 39     | Discontinuance Soldiers allotments.  |
| 24  | 41     | Soldiers deposit Book.   |
| 1   | 69     | Model remarks for army pay rolls (enlisted men).   |
| 1   | 70     | Instructions for army pay rolls (enlisted men).  |
| 50  | 160    | Requisition (Form used for all requests for supplies obtained from the Quartermaster Corps) To be made in accordance with printed instructions thereon.  |
| 150   | 160a   | Extra sheets to form 160.  |
| 200   | 165    | Individual clothing slips. Used by soldier in making request for clothing. Instructions on back of form.   |
| 12  |        | Statement of clothing issued to enlisted men.  |
| 12  | 180    | Abstract of clothing drawn or issued on individual slips.  |
| 12  | 176    | Requisitions for corn brooms, etc.   |
| <b>Property Account.</b> —Loose leaf form in ledger style, kept in binders on which all transactions in ordnance and quartermaster property are recorded. A separate sheet is used for each article and all entries are supported by voucher, numbered, serially from July 1st to June 30th, of each fiscal year. |        |  |
| —See A.G.O. Forms 599 and 599a.   |        |  |
| <b>Transfer Quartermaster Supplies.</b> —(See A.G.O. Form 600).   |        |  |
| 12  | 203    | Monthly list of Quartermaster Supplies Expended, prepared in duplicate, voucher to the property account covering articles expended in the care and upkeep of the organization.   |
| 3   | 205    | Articles lost or destroyed.  |

| Quantity Form<br>Required. No. | Description.   |
|--------------------------------|--|
| 12 210                         | List of articles taken up. Voucher to property account prepared in duplicate, showing property which is to be taken up as found etc.         |
| 12 213                         | Requisition for clothing; prepared in triplicate by the organization commander and sent direct to the Quartermaster who issues the clothing. |
| 12 217A                        | Voucher to Post Property Account.  |
| 1 223                          | Ration Returns (book).   |
| 1 227                          | Memorandum Receipt.  |
| 1 406                          | Official Telegram (book of 50).  |
| 36 416                         | Quarterly Report of Motor Trucks on hand.<br>(See Record of Operation and Maintenance.)  |
| 6 417                          | Quarterly Report on Automobiles on hand.<br>(See Record of Operation and Maintenance.)   |
| 12 434                         | Return of enlisted men, Quartermaster Corps.<br>(See also List "A".)   |
| 1 452                          | Company Council Book. (See Funds.)   |
| 30 493                         | Transfer of Motor Vehicle.   |
| 30 509                         | Delinquency Record (enlisted men). Loose leaf form for recording offences of enlisted men, their kind and punishment.                        |
| 1 174                          | Record of Service.   |
| 3                              | Statement of charges showing articles charged on pay rolls.  |

The local Quartermaster or Supply Office is ordinarily the source from which these forms may be obtained except No. 452 which is furnished by the Quartermaster General.

12 Public Form 330. Public Vouchers.

### Read Carefully the Instructions on Each Blank

"C."—Supplied by the Chief of Ordnance, Washington, or by Local Ordnance Officer

| Quantity Form<br>Required. No. | Description.  |
|--------------------------------|---|
|                                | <b>Property Account.</b> —Loose leaf form in ledger style, kept in binder on which all transactions in Ordnance and Quartermaster property are recorded. A separate sheet is used for each article and all entries are supported by voucher, numbered, serially from July 1 to June 30 of each fiscal year.—(See A.G.O. Forms Nos. 599 and 599a.) |
| 12                             | Ordnance return addition sheets with blank headings. To be filled in according to classification of stores received.....  |



| Quantity<br>Required. | Form<br>No. | Description.   |
|-----------------------|-------------|--|
| 4                     | 86          | Statement of Charges, to be posted as charges are entered and submitted with return.   |
| 12                    | 94          | Monthly report of Ordnance Charges, to be forwarded with the rolls on which charges are entered.   |
| 48                    | 152         | Transfer of Ordnance Supplies under par. 1535 A.R. in possession of enlisted men. Transfer of Ordnance Property.—(See A. G.O. Form 600.) |
| 12                    | 386         | Requisition for ordnance stores.   |

Instructions as to the preparation of the foregoing are printed on the forms. These should be carefully studied before making up.

#### Supplied by the Inspector General's Office

| Quantity<br>Required. | Form<br>No. | Description.                     |
|-----------------------|-------------|----------------------------------|
| 6                     | 1           | Inventory and Inspection Report. |
| 6                     | 1A          | Inner sheets for I. & I. Report. |

#### Supplied by the Bureau of War Risk Insurance

| Quantity<br>Required. | Form<br>No. | Description.   |
|-----------------------|-------------|--|
| 200                   | 2A          | Application for Insurance.   |
| 200                   | 1B          | Information for Allotment of Pay and Application for Family Allowance. |

#### Miscellaneous (Supplied through Adjutant's Office)

| Quantity<br>Required. | Form<br>No. | Description.               |
|-----------------------|-------------|----------------------------|
| 200                   | CCP1        | Qualification Record Card. |
| 300                   | 316         | Y. M. C. A. Data Cards.    |

### MISCELLANEOUS BOOKS AND PUBLICATIONS

1.—Supplied on form 383 A.G.O. by the Adjutant General of the Army.

- (a) Army Regulations.
- (b) Field Service Regulations.
- (c) Drill Regulations, Infantry.
- (d) Manual of Court Martial.
- (e) Manual Interior Guard Duty.
- (f) Small Arms Firing Manual.
- (g) Manual of Field Engineering.
- (h) Signal Book, U. S. Army.
- (i) Uniform Regulations.

(j) Compilation General Orders, Bulletins etc.

2.—Supplied Ordnance Department on request:.

(a) Ordnance Price List (Form 1897).

(b) Instructions for care and repair of small arms and Ordnance (Form 1965).

3.—Supplied by the Quartermaster General of the Army.

(a) Manual for the Quartermaster Corps, 1916.

4.—Copies of all General Orders, Bulletins and Circulars, issued from the various headquarters under which the company is serving. See Bulletin 53 WD. 1917. Binders in which to keep orders can be obtained by requisition on the Quartermaster.

5.—There should be kept on file in a loose leaf memorandum book with index, in which to enter such instructions, information, memoranda, etc., which may be very useful to retain for reference and which is not covered by other regulations or orders.

6.—Catalogues, instructions books, etc., for the make and kind of vehicles which the company is equipped.

7.—A standard hand book of motor vehicles recommended: "‘Dykes’" Automobile and Gasoline Engine Encyclopedia." This should be obtained by requisition on the Quartermaster.



## CHAPTER V

### EQUIPMENT FOR A MOTOR TRUCK COMPANY

Frequent reference will be made in this chapter to Equipment according to designations A B and C. Par. 19, Compilation of General Orders, War Department, 1881-1915, is quoted in full below so that reference to Equipment A, B and C throughout will be understood:

Instructions Pertaining to Field Equipment.—1. Field service is defined to be service in mobilization, concentration, instruction, or maneuver camps, as well as service in campaign, in simulated campaign, or on the march.

The complete equipment for field service (equipment "C") consists of engineer, ordnance, signal, medical, and quartermaster property, and is divided into two classes, "A" and "B."

Equipment "A" is the equipment prescribed for use in campaign, in simulated campaign, or on the march. It is limited to the animals and vehicles prescribed in the Tables of Organization, the equipment and clothing worn on the person, and the articles carried on mount, and transported in field, combat, and divisional trains.

Equipment "B" is the equipment which, in addition to equipment "A" is prescribed for the use of troops in mobilization, concentration, instruction, or maneuver camps, and during such pauses in operations against an enemy as permits the better care of troops.

Equipment "C" is the sum of equipments "A" and "B," and therefore includes every article prescribed for field service as hereinbefore defined.

When troops are ordered on field service, instructions will state the letter designation of the equipment to be taken. The instructions will also specify whether mosquito bars and head nets are to form a part of the equipment, and what winter articles, if any, are to be included. The same rule will apply in the issuance of subsequent orders when necessary. Articles distinctively for winter use can be transported as baggage on the march only when transportation in addition to that prescribed in equipment "A" is provided for that purpose. In addition to the allowances prescribed as the field equipments, service coats, cravats, fatigue clothing, and other articles of uniform, extra bedding, and toilet articles may be taken by officers and enlisted men with equipment "B" when authorized in orders directing the movement of troops.

2. The articles of engineer, ordnance, and signal property listed in the several Unit Accountability Equipment Manuals belong to equipment "A." The articles of medical property belonging to equipment "A" are shown in the manual for the



Medical Department. The articles of Quartermaster property belonging to equipments "A," "B" and "C," respectively, are shown in Equipment Tables, Quartermaster Supplies, 1915.

### Part 1

## PERSONAL (INDIVIDUAL) EQUIPMENT

### (A) ORDNANCE PROPERTY

(For Truckmaster, Chief Mechanic, and Cooks.)

(Class VII, Section 2)

1 Automatic pistol, cal. 45.

2 Magazines, pistol, extra.

(Class VIII, Section 2)

21 Cartridges, ball, pistol.

(Class IX, Section 1)

1 Canteen.

1 Fork.

1 Canteen Cover.

1 Spoon.

1 Can, bacon

1 Meat Can.

1 Can, condiment.

1 Haversack.

1 Cup.

1 Pack Carrier.

1 Knife.

1 Pouch, first aid.

(Class IX, Section 2)

1 Pistol holster.

(Class IX, Section 3)

1 Pistol belt.

(For all enlisted men except Truckmaster, Chief Mechanic, and Cooks.)

(Class VII, Section 1)

1 U. S. Rifle, cal. 30, model 1917.

1 Front sight cover.

1 Oiler and thong case.

1 Thong and brush.

(Class VIII, Section 1)

90 Ball cartridges, cal. 30.

(Class IX, Section 1)

1 Canteen.

1 Fork.

1 Canteen cover.

1 Spoon.

1 Can, bacon.

1 Meat can.

1 Can, condiment.

1 Haversack.

1 Cup.

1 Pack carrier.

1 Knife.

1 Pouch, first aid.

1 Cartridge belt.

(Class IX, Section 5)

1 Scabbard, for rifle.

**B.—QUARTERMASTER PROPERTY**

(For each Enlisted Man.)

- |  |                                |
|--|--------------------------------|
| 1 Bag, barrack.  | 2 Laces, shoe, pr. (extra)     |
| 2 Bed sacks.   | 5 Pins, shelter tent.          |
| 1 Belt, waist.   | 2 Leggings, pr.                |
| 3 Blankets   | 1 Ornaments, set.              |
| 2 Breeches, wool.  | 1 Overcoat.                    |
| 1 Brush, shoe, fr. each 8 men.                           | 1 Pole, shelter tent.          |
| 1 Brush, clothes, fr. ea. 8 men.                         | 2 Shirts, flannel, O.D.        |
| 2 Coats, wool.   | 1 Slicker.                     |
| 3 Drawers, heavy, wool.                                  | 2 Shoes, field, pr.            |
| 1 Gloves, winter, pr.                                    | 5 Stockings (prs.), wool, hvy. |
| 1 Hat, with tying cord.                                  | 2 Tags, identifi., with tape.  |
| 1 Hat cord   | 1 Tent, shelter half.          |
| 2 Laces, leggings, pr. (extra)                           | 3 Undershirts, heavy, wool.    |
| 1 suit blue denim for all troops except those in Europe. |                                |

## Additional: Toilet Articles.

- |                |               |                         |
|----------------|---------------|-------------------------|
| 1 Tooth brush. | 1 Comb.       | 1 Razor.                |
| 2 Towels.      | 1 Hair brush. | 1 Mirror, small, steel. |
| 1 Soap, cake.  |               | 1 Brush, shaving.       |

The toilet articles may ordinarily be obtained from the subsistence branch of the Camp Quartermaster's Office.

**C.—MEDICAL PROPERTY****For All Enlisted Men:**

- 1 packet, first aid.

Of the above quartermaster and medical property, the following is carried on the person:

- 1 Belt, waist.
- 1 Breeches, service.
- 1 Coat, service.
- 1 Cord, hat, sewed on.
- 1 Drawers, pair.
- 1 Gloves, pair.
- 1 Hat, service, with tying cord.
- 1 Leggings, canvass.
- 1 Overcoat.
- 1 Shirt ODW.
- 1 Shoes, field, pair.
- 1 Socks LW., pair.
- 2 Tags, identification with tape.
- 1 Undershirt.
- 1 First Aid Packet. Ribbons, when entitled thereto to be worn on blouse.

Chevrons of Cooks and Privates first-class on Overcoats, service and fatigue coats.

The following articles constitute the field kit, carried in Blanket Roll:

#### Toilet Articles

- 1 Brush, tooth.
- 1 Comb.
- 1 Soap, cake.
- 1 Shaving outfit.
- 1 Towel.

#### Clothing components

- 2 Blankets, ODW.
- 1 Drawers.
- 1 Gloves, pair.
- 1 Shelter half tent, with poles, rope and 5 pins.
- 1 Slicker.
- 2 Socks, LW, pairs.
- 1 Undershirt.

The following articles go into the surplus kit, to be carried with the squad kit bag.

- 1 Blanket.
- 1 Breeches, service.
- 1 Coat, service, folded in top of bag.
- 1 Drawers, pair.
- 1 Laces, leggings, pairs, extra.
- 1 Laces, shoes, pairs, extra.
- 1 Shirt, ODW.
- 1 Shoes, field, pair.
- 2 Socks LW. pairs.
- 1 Underwear.

The above articles, except coat, to be rolled together and tied with extra pair of shoe and legging laces and placed in the squad kit bag. Additional contents of kit bag to be:

- 1 Housewife. 1 Can foot powder. 2 Packages Toilet paper.
- 1 Shoe and 1 clothes brush.

### D.—BAGGAGE ALLOWANCE

Q.M. Sergeants and Sergeants 1st Class.

100 lbs. (This is in addition to Equipment C. It includes all clothing and bedding for extended field service).

Sergeants, Corporals, Privates 1st Class, Privates and Cooks.

75 lbs. (This is in addition to Equipment C. It includes all clothing and bedding for extended field service).

Enlisted men will use the standard barrack bag or its equivalent.

Except where otherwise noted the personal equipment on above tables is that allowed troops designated for overseas duty. When overseas orders are received, all shoes except field shoes will be turned into the Depot Quartermaster. Chauffeurs and motorcycle drivers are entitled to blanket-lined overcoats.

## Part 2

## COMPANY EQUIPMENT

## A. UNIT TRUCK EQUIPMENT

(Equipment for each ordinary cargo truck. Equipment C.)

- 1 Axe and helve.
- 1 Bucket, G. I.
- 1 Cable, towing (wire, about 18' long with loops and snaffle hooks, breaking strength not less than 12 tons).
- 1 Can, milk, 10 gal. (for water).
- 1 Driver's Daily Truck Report Book.
- 1 Extinguisher, fire, 1 qt. (Pyrene type) with brackets.
- 1 Flashlight, complete (1½"x8½"), nickel-plated.
- 1 Pick and helve.
- 2 Ropes, lash, ¾", 50 ft.
- 1 Spade.
- 3 Tape, roll, friction, large size.
- 2 Leather boots to hold rifle.

Each truck to be equipped with the following when shipped out from organization park (special to suit each make and model of truck):

- 1 Body.
- 7 Bows.
- 1 Canvas cover, truck.
- 1 Chain, mud, set.
- 1 Grease can, 5 lbs. (cup).
- 4 Spark plugs, extra.
- 1 Top, drivers, complete with apron, etc.
- 1 Truck tool kit, as supplied each truck by manufacturer Components vary with type of car, but should include:
  - 1 Chauffeur's tool kit.
  - 1 Auto Jack.
  - 1 Grease Gun.
  - 1 Can, squirt.
  - Wrenches.

## B. REPAIR TRUCK EQUIPMENT

The repair truck equipment includes chief mechanic's equipment and supplies, equipment and supplies for each assistant mechanic, and certain general items. This equipment is ordinarily carried on the baggage and ration truck, and when parts or tools are needed they will be obtained from baggage and ration truck and carried to place to be used on light repair truck in camp, to be kept in company work shop.

Chief Mechanic's Equipment  
Equipment C

- 1 Axe and helve.
- 1 Bag, tools mechanics, canvas, best quality.



- 1 Bar, crow, 5 ft. long, 18 lbs., one end wedge.
- 1 Bar, steel, 2½ ft. long, best quality, lip on one end, drawn to point on other.
- 1 Bit, expansion with cutters to cut ⅝" to 1⅛" and 1⅛" to 1¾" set.
- 1 Block, tackle, steel duplex set for 1" rope, with 300' rope.
- 2 Bolos.
- 1 Can, oil, squirt small.
- 1 Card, file, 4"x7½" wire bristle.
- 1 Chisel, cape, octagon bar ½".
- 1 Chisel, cape, octagon bar ¾".
- 1 Chisel, cold, octagon bar ½"x5".
- 1 Chisel, cold, octagon bar ¾"x7½".
- 1 Cutter, washer, felt, adjustable.
- 1 Drill, breast, two speed, ball bearing adjustable 3 jawed chuck for straight shank drills, 0 to ½", designed small but heavy, for use in confined space, with chain attachment.
- 1 Drift, brass 8".
- 1 Drift, brass 10".
- 2 Funnels, 8", copper plated, with screen.
- 1 Gauge, thickness, .004" to .025".
- 1 Gauge, screw thread pitch 4 to 42 threads per in., U. S. S. and S. A. E.
- 2 Hammers, machinists ball pein, polished, best quality, 2 lb. with handle.
- 2 Hammers, machinists ball pein, 1 lb. polished, best quality, with handle.
- 1 Handle, spare, hickory, for ball pein 2 lb. hammer with wedge.
- 1 Handle, spare, hickory, for ball pein 1 lb. hammer with wedge.
- 1 Handle, spare, hickory, for 8 lb. hammer, 32" long with wedge.
- 6 Handles, spare, hickory, for files.
- 1 Iron, copper soldering, 2 lb. with handle.
- 1 Iron, copper soldering, 4 lb. with handle.
- 1 Jack, 15 ton, double action, 15" rise.
- 1 Knife, special, for rubber tires, 1" blade, 4" long.
- 2 Lanterns, oil.
- 1 Light, flash, nickel, 1½x3½ in., bulb and battery.
- 1 Measure, 1-gal. size, for oil.
- 1 Pick and helve.
- 1 Plier, adjustable 6".
- 1 Plier, adjustable 10".
- 1 Plier, side cutting 8".
- 1 Plier with long round nose and flat jaw 6".
- 1 Punch, center, ⅜" dia. 4" long.
- 1 Punch, solid ¼".
- 1 Punch, solid ⅜".
- 1 Punch, solid ¾".
- 1 Reamer, set of taper, sizes No. 0, 1, 2, 3, 4, and 5 in., standard hardwood case.

- 1 Rule, steel 6" and  $\frac{3}{4}$ " wide, spring tempered graduated 8ths, 16ths, 32nds and 64ths.
- 1 Rule, folding, 6" best quality.
- 1 Saw, hack, frame adjustable, 8" to 12".
- 1 Scraper, bearing, set of three, best quality, drop forge.
- 1 Scraper, carbon, set of three in a box.
- 1 Screwdriver, perfect handle 6".
- 1 Screwdriver, perfect handle 12".
- 1 Screwdriver, perfect handle 8",  $\frac{1}{4}$ " point.
- 1 Screwdriver, off set  $\frac{5}{16}$ "x6".
- 1 Screwdriver, off set 1"x8".
- 1 Snips, 12" tinners, straight, best quality.
- 1 Snips, short, round nose, for circular cutting.
- 1 Stamping set, complete  $\frac{3}{8}$ " alphabets and numbers.
- 1 Torch, blow, 1 qt. double burner and brazer with adjustment for height.
- 1 Valve lifter, universal chain type.
- 1 Vise, 4" combination.
- 1 Wrench, set of socket, equivalent to Mosberg No. 14 ratchet handle, extension bar, universal joint, 34 pressed steel sockets, etc.
- 1 Wrench, set of, adjustable heavy type 4"—6"—10".
- 1 Wrench, set stilson 6" and 10" in tool roll.
- 1 Wrench, set stilson 14" and 24" in tool roll.
- 1 Wrench, monkey 24".
- 1 Wrench, bicycle, thin, best quality.

### Supplies—Equipment A

- 1 Acid, muriatic, pint.
- 10 Batteries for flashlight  $1\frac{1}{2}$ "x8 $\frac{1}{2}$ ".
- 12 Blades, hack saw, 24 teeth per inch.
- 1 Bolt, carriage  $\frac{1}{2}$ "x8 $\frac{1}{2}$ ", box of 25 with nuts.
- 1 Bolt, carriage  $\frac{3}{8}$ ", assorted lengths with nuts 25 in box.
- 1 Bolt, carriage  $\frac{1}{2}$ " assorted lengths with nuts 25 in box.
- 1 Bolt, stove button head,  $\frac{3}{16}$ "x $\frac{3}{4}$ " with nuts 25 in box.
- 1 Bolt, stove button head,  $\frac{3}{16}$ "x3" with nuts 25 in box.
- 1 Bolt, stove button head,  $\frac{1}{4}$ "x1" with nuts 25 in box.
- 1 Bolt, stove button head,  $\frac{5}{16}$ "x3" with nuts 25 in box.
- 1 Bottle, glass, 1 qt. capacity in fiber container.
- 1 Brass, sheet, 7x26 in., 20 guage.
- 1 Brush, steel wire.
- 1 Brush, 3" paint.
- 10 Bulbs, flash light, packed in wooden or metal case.
- 6 Cloth, emery, sheets No. 00.
- 6 Cloth, emery, sheets No. 1.
- 6 Cloth, emery, sheets No. 2.
- 1 Compound, grinding, coarse and fine, box.
- 1 Cotter pin, box assorted.
- 1 Cotter pin, box  $\frac{3}{32}$ "x1".
- 1 Cotter pin, box  $\frac{1}{16}$ "x1".

- 1 Drill, set of straight shank,  $1/16''$  to  $1/2''$  by 64ths.
- 1 Fiber board  $1/4'' \times 12'' \times 12''$ .
- 1 Felt,  $3/8''$  thick  $12'' \times 24''$  pieces.
- 1 File, flat bastard 8".
- 1 File, smooth, 8".
- 1 File, single cut 8" mill bastard.
- 1 File, hand bastard 12".
- 1 File, hand bastard round 6".
- 1 File, hand bastard 6".
- 1 File, platinum contact, No. 6.
- 1 File, hand bastard round 12".
- 1 File, half round, mill bastard 8".
- 1 File, half round, mill bastard 10".
- 1 Gloves, rubber, pair.
- 1 Grease, cup, 5 lb. can.
- 1 Hydrometer, packed in wood or metal case.
- 10 Nails, 10d, pounds.
- 5 Nails, 20d, pounds.
- 5 Nails, 8d, pounds.
- 1 Oil 3 in 1 bottle pint.
- 6 Paper, sand No. 00 sheets.
- 1 Paste, soldering, 3 sticks per lb.
- 1 Rivet, and burrs copper, assorted  $5/8''$  and  $3/4''$  long in box.
- 1 Sal-Ammoniac, pounds.
- 1 Screws, cap Hex Hd. assorted sizes with nuts U. S. S. box.
- 1 Screws, cap Hex Hd. assorted sizes with nuts S. A. E. box.
- 1 Screws, wood assorted sizes, 50 in box.
- 1 Sealing wax, sticks.
- 1 Shellac, pints.
- 1 Shim-stock, box assorted.
- 1 Solder, rosin core, spool.
- 3 Tape, friction, about 4" dia. rolls.
- 1 Tape, rubber, 1 lb.
- 2 Washers, lock, assorted box.
- 15 Waste, lbs.
- 2 Wicks, lantern.
- 1 Wire, copper No. 16,  $1/2$ -lb. spool.
- 1 Wire, copper No. 12, 1 lb.
- 1 Wire, steel No. 16, 10 lbs.
- 50 Wire, electric cord (brewery No. 14) ft.
- 15 Wire, electric magneto cable, feet.

Varying from Zero for light service to twice "A" for severe field service determined by condition of service, accessibility of base and consideration for weight and space. Varying from "A" as minimum to three "A" as maximum.

## Each Assistant Mechanic's Equipment and Supplies

## Equipment C

- 1 Axe and helve.
- 1 Bag, tools, mechanics, canvas, best quality.
- 2 Bolos.
- 1 Card file 4"x7½" wire bristle.
- 1 Chisel, cape octagon bar ½".
- 1 Chisel, cape octagon bar ¾.
- 1 Chisel, cold octagon bar ½x5.
- 1 Chisel, cold octagon bar ¾x7½.
- 1 Drift, brass 10".
- 2 Funnels, 8" copper plated with screen.
- 2 Hammers, machinist, ball pein, polished, best quality, 2 lbs., with handle.
- 2 Hammers, machinist, ball pein, 1 lb., polished, best quality, with handle.
- 1 Knife, special for rubber tires, 2" blade, 4" long.
- 2 Lanterns, oil.
- 1 Light, flash, nickle, 1½x8½, one bulb and battery.
- 1 Measure, 1 gal. size, for oil.
- 1 Pick and helve.
- 1 Plier, adjustable, 6".
- 1 Plier, adjustable, 10".
- 1 Plier, side cutting, 8".
- 1 Plier, with long round nose and flat jaw 8".
- 1 Punch, center ⅜", dia. 4" long.
- 1 Punch, solid ¼" dia.
- 1 Punch, solid, ⅝" dia.
- 1 Punch, solid, ¾" dia.
- 1 Saw, hack, frame adjustable, 8" to 12".
- 1 Screwdriver, perfect handle, 6".
- 1 Screwdriver, perfect handle, 12".
- 1 Screwdriver, perfect handle, 8"x¼" point.
- 1 Screwdriver, offset 5/16x6".
- 1 Valve lifter, universal chain type.
- 1 Wrench, adjustable, set of heavy type, 4"-6"-10".
- 1 Wrench set stillson, 6" and 10", tool roll.
- 1 Wrench, bicycle, thin, best quality.
- 1 Wrench, monkey, 24".

## Supplies—Equipment A

- 10 Batteries for flash light 1½x8½.
- 12 Blades, hack saw, 24 teeth per inch.
- 1 Bolt, carriage, ½", assorted lengths with nuts, 25 in box.
- 1 Bolt, carriage, ½x8½, with nuts, 25 in box.
- 1 Bolt, carriage, ⅜", assorted lengths, with nuts, 25 in box.
- 1 Bolt, stove, button head, 3/16x¾", with nuts, 25 in box.
- 1 Bolt, stove, button head, 3/16x3", with nuts, 25 in box.



- 1 Bolt, stove, button head,  $\frac{1}{4} \times 1''$ , with nuts, 25 in box.
- 1 Bolt, stove, button head,  $\frac{5}{16} \times 2''$ , with nuts, 25 in box.
- 1 Bottle, glass, 1 qt. capacity, in fiber container.
- 1 Brush, steel wire.
- 1 Brush, 3" paint.
- 10 Bulbs, flash light, packed in wood or metal case.
- 6 Cloths, emery sheets, No. 00.
- 6 Cloths, emery sheets, No. 1.
- 6 Cloths, emery sheets, No. 2.
- 1 Compound, grinding coarse and fine, box.
- 1 Cotter pin, box, assorted.
- 1 Cotter pin, box,  $\frac{3}{32} \times 1''$ .
- 1 Cotter pin, box,  $\frac{1}{16} \times 1''$ .
- 1 File, flat, bastard, 8".
- 1 File, smooth, 8".
- 1 File, single cut, 8", mill bastard.
- 1 File, hand bastard, 12".
- 1 File, hand bastard, 6".
- 1 File, hand bastard, round, 6".
- 1 File, platinum contact.
- 1 File, hand bastard, round, 12".
- 1 File, half round, mill bastard, 8".
- 1 File, half round, mill bastard, 12".
- 1 Grease, cup, 5 lbs.
- 1 Hydrometer, packed in wood or metal case.
- 10 Nails, 10d lbs.
- 5 Nails, 8d lbs.
- 5 Nails, 20d.
- 1 Rivet and burr, copper, assorted,  $\frac{5}{8} \times \frac{3}{4}''$  long, in boxes.
- 1 Screw, cap, hex hd., assorted sizes with nuts, U. S. S., box.
- 1 Screw, cap, hex hd., assorted sizes with nuts, S. A. E., box.
- 1 Screw, wood, assorted sizes, box of 50.
- 1 Shellac, pint.
- 3 Tape, roll friction about 4" dia., rolls.
- 2 Washers, lock, assorted box.
- 15 Waist, lbs.
- 1 Wire, copper, No. 16  $\frac{1}{2}$ -lb. spools.
- 1 Wire, copper, No. 12 1-lbs.
- 1 Wire, steel, No. 16, 10 lbs., 2 spools.
- 50 Wires, electric, double insulated (brewery cord, No. 14), ft.
- 15 Wires, Magneto cable, ft.

Varying from Zero for light service to twice "A" for severe Field Service.

Determined by condition of service, accessibility of base and consideration of weight and space.

Varying from "A" as minimum to three times "A" as maximum.

## GENERAL EQUIPMENT FOR REPAIR TRUCK

### EQUIPMENT C

- 1 Container, G. I., 5-gal. cap (for kerosene).
- 1 Container, G. I., 5-gal. cap (for lub. oil).
- 1 Container, G. I., 5-gal. cap (for heavy oil).
- 1 Container, Carboy, glass, 5-gal. cap (for distilled water).
- 1 Gas, oxygen tank, 200 ft. capacity.
- 1 Gas, acetylene tank, 200 ft. capacity.
- 6 Lumber, poplar, 1"x12"x10' pieces.
- 4 Lumber, oak, 1"x6"x8' pieces.
- 2 Lumber, yellow pine, 2"x4"x6' pieces.
- 2 Lumber, yellow pine, 4"x4"x6' pieces.
- 10 Oil, lubricating, gallons.
- 10 Oil, heavy (600W), gallons.
- 10 Oil, kerosene, gallons.
- 1 Rope, Manila,  $\frac{3}{4}$ ", 1200 ft. (1 pkge.).
- 1 Rope, Manila, 1", 300 ft., wrapped in burlap.
- 8 Steel, bars,  $\frac{3}{8}$ "x1 $\frac{1}{4}$ ", 10 ft. long.
- 1 Steel, cold, rolled,  $\frac{3}{8}$ " round, 10 ft. long.
- 1 Steel, cold, rolled,  $\frac{1}{2}$ " round, 10'.
- 1 Steel, cold, rolled,  $\frac{5}{8}$ " round, 10'.
- 1 Tool, farriers and blacksmith, set (Q. M. Manual).
- 1 Tool, wheelwrights and carpenters, set (Q. M. Manual).
- 1 Welding equipment as follows:
  - 2 flux brazing, lbs.
  - 2 flux welding c.i., lbs.
  - 4 glasses, dark
  - 2 red cast iron  $\frac{3}{16}$ " dia. lbs.
  - 2 rods aluminum  $\frac{3}{16}$ " dia. lbs.
  - 2 rods, bronze,  $\frac{3}{16}$ " dia. lbs.
  - 2 rods, steel,  $\frac{3}{16}$ " dia. lbs.

## SPECIAL FOR EACH MAKE AND MODEL OF TRUCK

- 1 Gear and wheel puller.  
This to be adapted to truck so as to handle all gears and wheels. If all gears and wheels cannot be handled by one instrument, the above should consist of a set that will.
- 1 Screw Plate, set, for all sizes and standards of thread used on truck, complete in hardwood case, with dies, collets, taper taps and two adjustable tap wrenches.
- 1 Tool, set, special for make and model of truck. This set to consist of special socket wrenches, open end wrenches and accessories wrenches, and other tools necessary for work on truck that standard wrenches and tool equipment will not handle.

### C. GASOLINE TRUCK EQUIPMENT

#### EQUIPMENT C

- 1 hose, gasoline, complete, 20';
- 1 pump, gasoline, complete, with connection to fit a 55 gallon drum;
- 10 drums for 3 ton truck, (4 for 1½-ton truck).
- 6 funnels, large, heavy metal.
- 6 measures, oil, 2-quart, heavy metal.
- 6 measures, 5 gallons, heavy metal.
- (Omit truck cover and bows.)

### D. PASSENGER CAR EQUIPMENT

(For each Roadster Equipment C.)

- 1 Air guage.
- 1 Bucket, canvas.
- 1 Cable, towing, ¼", power steel type with hooks.
- 1 Chain, tire (set of two).
- 1 Cover, escort wagon.
- 1 Fire extinguisher, 1-qt. size with bracket.
- 1 Flash light, nicked, 1½x8½".
- 1 Grease, can, 5 lbs.
- 1 Hatchet.
- 1 Lamp, electric, trouble 6 volt, 6 c. p. with 25 feet of lamp cord and socket connection same as socket for lamp on car.
- 1 Oil can.
- 1 Pump, tire.
- 1 Pennant, Q. M. C., 27"x41", with staff.
- 2 Rims, extra.
- 1 Rope lash, ½"x50'.
- 1 Tape, friction, roll.
- 1 Tire, inner tube for (extra).
- 1 Tool kit, including:
  - Grease gun
  - Pliers
  - Wrenches
  - Special tools for car etc.
  - Jack

### E. KITCHEN EQUIPMENT

#### EQUIPMENT C

(To be kept on Kitchen Truck or in Kitchen of Company, or on Baggage and Ration Truck.)

- 2 Axes and helvcs.
- 3 Buckets, G. I.
- 3 Brushes, scrubbing.
- 1 Can, G. I., 15 gal.
- 5 Cans, milk, 5 gal., heavy metal.

- 2 Hatchets.
- 6 Lanterns.
- 2 Picks and helves.
- 2 Spades.
- 1 Tent, fly, hospital, complete with poles.
- 1 Range, field No. 1, complete, which includes:
  - 1 field range (1 body, No. 41, and 1 boiling plate, No. 42.)
  - 1 Alamo attachment (2 pieces, 42a and 42b).
  - 6 boilers, Nos. 48, 49, 50, 51, 53, and 54).
  - 1 cleaver, 6 inch.
  - 1 dipper,  $\frac{1}{2}$  gallon, No. 55.
  - 1 dipper, quart, No. 56.
  - 2 forks, small.
  - 1 grinder, meat.
  - 1 tent guard,  $6\frac{1}{2}$  inches.
  - 3 knives, butcher, 8 inches.
  - 2 pans, bake, No. 52.
  - 1 pipe, smoke, elbow, No. 47.
  - 4 pipes, smoke, joints, Nos. 43, 44, 45, and 46.
  - 4 rests, pan, No. 57.
  - 1 saw, meat, 15-inch blade.
  - 1 skimmer, large.
  - 2 spoons, large.
  - 1 steel, butchers, 10 inches.

## F. GENERAL EQUIPMENT

### EQUIPMENT C

(To be kept in store room or issued to proper individuals.)

- 6 Axes and helves.
- 10 Bags, surplus kit.
- 1 Bag, water, sterilizing.
- 1 Brush, marking.
- 1 Brush, typewriter, type cleaning.
- 5 Buckets, G. I.
- 1 Can, drinking water, 5 gal.
- 1 Canvas, Latrine screen, 5'x40'.
- 1 Desk, field, large
- 7 Flashlights, complete (for truckmaster, assistant truckmasters, mechanic and assistant mechanics).
- 6 Gaskets for gasoline pump
- 12 Funnels, large (heavy metal).
- 1 G. I. can, 15 gal.
- 1 Hose, gasoline, complete, with stop cock and nozzle, nipples one union to connect pump.
- 10 Housewives.
- 2 Lamp black, pounds.
- 3 Lanterns, complete.
- 5 Liquid, Pyrene fire extinguishers, gallons.
- 12 Measures, oil, 2 quart, heavy metal.



- 12 Measures, garage, 5 gallon, heavy metal.
- 1 Oil, typewriter, bottle.
- 2 Pennants, Q. M. Corps, 48x72, with staffs (for the leading and the rear trucks).
- 1 Paulin, large.
- 6 Pickaxes and helves.
- 350 Pins, tent, large.
- 300 Pins, tent, small.
- 1 Pot, marking.
- 90 Powder, calcium chloride, tubes.
- 1 Pump, gasoline, complete, with all fittings and with suction tube and connection to fit a 55-gal. drum with 1½ pipe opening.
- 6 Rakes, steel.
- 200 Rope, manila, ¼ inch, feet (for truck covers).
- 1000 Rope, manila, ¾ inch, feet (for lashes).
- 2 Sheets, wagon, for passenger cars.
- 11 Spark arresters.
- 1 Stencil plates, set.
- 1 Stick, size, shoe.
- 11 Stoves, tent, for winter use only.
- 1 Stove, shield.
- 11 Stove pipe elbows, for winter use only.
- 57 Stove pipe joints.
- 1 Stretcher, shoe.
- 1 Tape, foot measure.
- 1 Tape, steel, 100 feet.
- 1 Tent, pyramidal, complete, small.
- 12 Tents, pyramidal, complete, large (1 for office, 1 for storage, and 1 for each 8 men).
- 1 Typewriter.
- 1 Wheelwrights and carpenters set.
- 5 Whistles and chains (for Company Commander, Truckmaster, and Assistant Truckmasters).

### ORDNANCE PROPERTY

- 5 Arm chests, rifle.
- 1 Arm locker, pistol.
- 5 Cleaning Rods, brass.
- 10 Screwdrivers, rifle.
- 1 Stamping set, steel, alphabet and numbers, for marking, identification tags, size ⅜".

### VEHICLE EQUIPMENT

- 1 Vehicle, motor car, roadster.
- 1 Vehicle, auto truck, light repair.
- 27 Vehicles, auto trucks, complete, cargo.
- 1 Vehicle, auto truck, complete, baggage and ration.
- 1 or 2 Vehicles, auto truck, complete, gasoline carrying.
- 1 Vehicle, auto truck, complete, kitchen, trail mobile type.
- 1 Motorcycle, with side car attachment.

**AS REQUIRED**

Candles (See A. R. 1215; Q. M. C., Form 223).  
Fuel (See Q. M. C., Form 447).  
Lime (See Q. M. C., Form 447)  
Matches (See A. R. 1215; Q. M. C., Form 223).  
Oil, gasoline (180 gal., estimated 10 days supply, Equipment C).  
Oil, lubricating.  
Oil, mineral.  
Oil, neats-foot.  
Oil, grease (3 box of 12 5-lb. cans each, estimated 10 days supply, Equipment C).  
Oil, transmission (3 gal., estimated 10 days supply, Equipment C).  
Paper, toilet (See A. R. 1215; Q. M. C., Form 223).  
Rations, Field or Reserve, as ordered.  
Soap (See A. R. 1215; Q. M. C., Form 223).  
Straw, for bed-sacks (See A. R. 1084).

**QUARTERLY ALLOWANCE OF EXPENDABLE MATERIAL**

Brooms (See A. R. 1181).  
Brushes, scrubbing (See A. R. 1181).  
Lantern-globes.  
Lamp-wicks.  
Lye (See A. R. 1182).  
Mopheads (See A. R. 1181).  
Mop-handles (See A. R. 1181).  
Sapolio (See A. R. 1182).  
Stove-blackening.

**G. STATIONERY  
(Q. M. C., Form 204)**

A field desk, when packed, must not exceed 35 pounds in weight, except for Brigade and Division Headquarters. The contents include records, manuals, blanks and stationery. The stationery for a single desk shall not exceed the following, which is prescribed as an allowance for 3 months. This allowance applies also to each field desk not furnished by the Quartermaster Corps.

3 Bands, rubber, No. 18, gross.  
12 Blocks, memo or scratch note, for pencil.  
6 books, duplicating, letter size.  
600 envelopes, official.  
3 erasers, rubber, ink and pencil.  
3 erasers, rubber, typewriter.  
1 eraser, steel.  
3 fasteners, paper, boxes.  
3 files, office, for orders.  
18 ink, black, powdered, packages.  
9 ink, red, powdered, packages.  
3 mucilage (or paste), bottle or tube.

- 18 paper, blotting, 4 by 9½ inches, sheets.
- 6 paper, blotting, 12 by 19 inches, sheets.
- 75 paper, carbon, letter size, sheets.
- 15 paper, letter, typewriter quires.
- 12 pencils, indelible.
- 6 pencils, lead.
- 6 pencils, colored, blue and red.
- 12 penholders.
- 72 pens, steel.
- 3 pins, office, cones.
- 6 ribbons, typewriter, record.
- 1 ruler, office, 12-inch.
- 1 shears, office.
- 3 tape, office, spools.
- 3 twine, wrapping, balls.
- 9 wax, sealing, ounces.

### H. SIGNAL PROPERTY

- 1 Field phone, carried on company commander's roadster.
- 3 Buzzers, each carried by assistant truckmasters.
- 1 Flag kit, combination, carried by messenger.
- 1 Field glass, type E, carried by truckmaster.

### I. ENGINEER PROPERTY

- 3 Compass watches, one carried by each assistant truckmaster.

## J. EQUIPMENT FOR HEADQUARTERS COMPANY AND MEDICAL DETACHMENT

The headquarters company has for vehicle equipment:

- 1 Motor car, touring, for commanding officer.
- 1 Motorcycle, with side car, for first class private, assistant chauffeur, as messenger.
- 1 Truck, baggage and ration.

Individual quartermaster, ordnance, and medical property to which its members are entitled are of course the same as that for enlisted members of any motor truck company.

The baggage and ration truck should be supplied with the unit truck equipment.

General company equipment, kitchen equipment, supply of blank forms to which the company is entitled may be figured according to its proportion of strength with the motor truck company.

Its supply of stationery would be kept with that of Supply Train headquarters, and twice the periodical allowance for one motor truck company would surely be needed.

The motor vehicle equipment of the medical department includes:

- 1 Ambulance, motor.
- 2 Motorcycles with side cars.
- 1 Truck, cargo, 2-ton.

## K. SPARE PARTS.

Spare parts are divided into two classes: First, those common to all machines, like tubes, tires, etc., and, second, those special for the different makes. The main supply depot is in Paris and an agent from each army park goes daily to the depot and secures personally the supplies needed. Mistakes are thus avoided. This depot can manufacture almost any type of spare part. Partly worn-out pieces, tools, etc., are sent to the depot to be made over.

To show the number of spare parts required, it is only necessary to point out that if the supply was stopped for one month 50 per cent. of the vehicles would be out of commission.

The following table lists in detail the spare parts required for a three-ton Packard train. This list was tabulated from detailed information showing all such Packard parts shipped by the Southern Department during the past fifteen months. Many parts, for which the demand is infrequent, have been omitted in order to prevent the accumulation of heavy parts.

This table will also be found most valuable as a guide and basis for determining the requirements in spare parts for trains equipped with other designs of trucks.

(c) No Spare Parts over and above absolute requirements for immediate use will be kept on hand by companies quartered at a Parts Depot and supplied directly therefrom.

While it is contemplated that under the severe stress of active service with the consequent damage and destruction of material, the spare parts required will be "A" for ten days, "B" (twice "A") for twenty days, and "C" for thirty days, for light service of the interior equipment "A" should suffice for thirty days.

It is further contemplated that troops absent from the base will in REQUISITIONING FOR SPARE PARTS, wire or otherwise call for replacement by complete lists, i.e., "A," "B" or "C" as circumstances warrant, thus avoiding long and tedious work in the preparation of requisitions which will at the best be incomplete and inaccurate.

**Bulk and Weight.**—The following information with reference to bulk and weight of "Spare Parts, Table No. 19," will serve to determine the limits which conditions may make necessary or convenient to carry.

| Equipment     | No. of Boxes | Aggregate No. | Gross Weight |
|---------------|--------------|---------------|--------------|
| 3 ton Packard | (standard)   | of pieces     | lbs.         |
| "A"           | 9            | 2532          | 2203         |
| "C"           | 36           | 7674          | 8469         |

## LIST OF SPARE PARTS

| Part No. | Name             | "A" | "B" | "C" |
|----------|------------------|-----|-----|-----|
| 3078     | Castle nut ..... | 10  |     |     |
| 3082     | Castle nut ..... | 25  |     |     |
| 3088     | Castle nut ..... | 25  |     |     |



| Part No. | Name                | "A" | "B" | "C" |
|----------|---------------------|-----|-----|-----|
| 3091     | Castle nut .....    | 20  |     |     |
| 3096     | Castle nut .....    | 20  |     |     |
| 3104     | Castle nut .....    | 10  |     |     |
| 3108     | Castle nut .....    | 10  |     |     |
| 3006     | Plain nut .....     | 10  |     |     |
| 3008     | Plain nut .....     | 30  |     |     |
| 3015     | Plain nut .....     | 50  |     |     |
| 3022     | Plain nut .....     | 50  |     |     |
| 3029     | Plain nut .....     | 30  |     |     |
| 3037     | Plain nut .....     | 10  |     |     |
| 3065     | Plain nut .....     | 10  |     |     |
| 3092     | Plain nut .....     | 10  |     |     |
| 3127     | Plain nut .....     | 10  |     |     |
| 3134     | Lock nut .....      | 20  |     |     |
| 3138     | Lock nut .....      | 20  |     |     |
| 3140     | Lock nut .....      | 20  |     |     |
| 3523     | Castle nut .....    | 5   |     |     |
| 3526     | Castle nut .....    | 5   |     |     |
| 3760     | Screw .....         | 10  |     |     |
| 3777     | Screw .....         | 10  |     |     |
| 4134     | Screw N. P. ....    | 10  |     |     |
| 3111     | Set screw .....     | 10  |     |     |
| 4115     | Set screw .....     | 10  |     |     |
| 4116     | Set screw .....     | 10  |     |     |
| 3782     | Machine screw ..... | 10  |     |     |
| 3783     | Machine screw ..... | 10  |     |     |
| 3009     | Nit N. P. ....      | 10  |     |     |
| 3131     | Check nut .....     | 10  |     |     |
| 3134     | Check nut .....     | 10  |     |     |
| 4000     | Key .....           | 5   |     |     |
| 4001     | Key .....           | 5   |     |     |
| 4023     | Key .....           | 5   |     |     |
| 4039     | Key .....           | 5   |     |     |
| 4550     | Woodruff key .....  | 5   |     |     |
| 4551     | Woodruff key .....  | 5   |     |     |
| 4555     | Woodruff key .....  | 5   |     |     |
| 4556     | Woodruff key .....  | 5   |     |     |
| 4557     | Woodruff key .....  | 5   |     |     |
| 4558     | Woodruff key .....  | 5   |     |     |
| 4559     | Woodruff key .....  | 5   |     |     |
| 3813     | Pin clevis .....    | 10  |     |     |
| 3815     | Pin clevis .....    | 10  |     |     |
| 3816     | Pin clevis .....    | 10  |     |     |
| 3819     | Pin clevis .....    | 10  |     |     |
| 3826     | Pin clevis .....    | 10  |     |     |
| 3829     | Pin clevis .....    | 20  |     |     |
| 3847     | Pin clevis .....    | 10  |     |     |
| 3852     | Pin clevis .....    | 10  |     |     |
| 4449     | Pin .....           | 5   |     |     |
| 4637     | Pin .....           | 5   |     |     |

| Part No. | Name             | "A" | "B" | "C" |
|----------|------------------|-----|-----|-----|
| 4708     | Pin .....        | 5   |     |     |
| 4832     | Wood screw ..... | 10  |     |     |
| 4829     | Wood screw ..... | 10  |     |     |

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### LIST OF SPARE PARTS

| Part No. | Name             | "A" |
|----------|------------------|-----|
| 4921     | Wood screw ..... | 10  |
| 4952     | Wood screw ..... | 10  |
| 3364     | Clamp bolt ..... | 10  |
| 3365     | Clamp bolt ..... | 10  |
| 3366     | Clamp bolt ..... | 10  |
| 3417     | Clamp bolt ..... | 10  |
| 2999     | Bolts .....      | 10  |
| 3305     | Bolts .....      | 10  |
| 3298     | Bolts .....      | 10  |
| 3315     | Bolts .....      | 10  |
| 3325     | Bolts .....      | 10  |
| 3332     | Bolts .....      | 20  |
| 3338     | Bolts .....      | 10  |
| 3343     | Bolts .....      | 10  |
| 3345     | Bolts .....      | 10  |
| 3350     | Bolts .....      | 10  |
| 3354     | Bolts .....      | 10  |
| 3374     | Bolts .....      | 10  |
| 3394     | Bolts .....      | 10  |
| 3401     | Bolts .....      | 10  |
| 3484     | Bolts .....      | 10  |
| 3492     | Bolts .....      | 10  |
| 4066     | Bolts .....      | 10  |
| 4076     | Bolts .....      | 10  |
| 4666     | Bolts .....      | 10  |
| 3172     | Stud .....       | 20  |
| 3193     | Stud .....       | 10  |
| 3237     | Stud .....       | 20  |
| 5614     | Stud .....       | 10  |
| 5615     | Stud .....       | 10  |
| 5616     | Stud .....       | 20  |
| 5617     | Stud .....       | 10  |
| 5625     | Stud .....       | 10  |
| 5626     | Stud .....       | 10  |
| 5635     | Stud .....       | 5   |
| 5636     | Stud .....       | 5   |
| 5645     | Stud .....       | 10  |
| 5646     | Stud .....       | 10  |
| 6747     | Stud .....       | 10  |

| Part No. | Name   | "A" |
|----------|--|-----|
| 5655     | Stud .....   | 10  |
| 3940     | Key .....  | 10  |
| 3961     | Key .....  | 10  |
| 3996     | Key .....  | 10  |
| 40389    | Motor connecting rod bolt.....                           | 32  |
| 56906    | Steering cross tube ball socket casing<br>cap bolt ..... | 20  |

### EXHAUST MANIFOLD

(None)

### POWER PRESSURE PUMP

|        |   |   |
|--------|---|---|
| 65644  | Gas, power pressure pump cyl. gasket..                          | 4 |
|        | Gas, power pressure pump cyl. pist. and<br>valve assembly ..... | 1 |
| 664029 | Gas, power pressure pump eccentric rod                          | 1 |
| 5401   | Gas, power pressure pump tube elbow                             | 4 |

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### LIST OF SPARE PARTS

#### IGNITION

| Part No. | Name   | "A" |
|----------|--|-----|
| 02541    | Ignition high tension cable to spark<br>plug No. 1 assembly..... | 3   |
| 602501   | Ignition high tension cable to spark<br>plug No. 2 assembly..... | 3   |
| 602561   | Ignition high tension cable to spark<br>plug No. 3 assembly..... | 3   |
| 602601   | Ignition high tension cable to spark<br>plug No. 4 assembly..... | 3   |
| 67100    | Ignition spark plug assembly, $\frac{7}{8}$ x18<br>thread .....  | 33  |
| 42123    | Ignition spark plug gasket, $\frac{7}{8}$ inside..               | 33  |
| 073637   | Magneto breaker complete 3.....                                  | 22  |
| 073641   | Magneto breaker buffer spring.....                               | 6   |
| 073649   | Magneto breaker cover spring and stud<br>assembly .....          | 6   |
| 073042   | Magneto breaker contact screw (with<br>platinum point) .....     | 12  |
| 073651   | Magneto breaker and bearing holder<br>screw .....                | 3   |
| 073652   | Magneto breaker finger spring.....                               | 6   |
| 073653   | Magneto breaker finger spring screw..                            | 6   |
| 073654   | Magneto breaker grounding screw....                              | 12  |
| 073655   | Magneto breaker lever complete (with<br>platinum point) .....    | 6   |

| Part No. | Name   | "A" |
|----------|--|-----|
| 073656   | Magneto breaker lever spring.....                    | 3   |
| 073657   | Magneto condenser .....                              | 6   |
| 72684    | Magneto and coupling ass'y (Dixie)..                 | 2   |
| 073661   | Magneto distributor block complete...                | 3   |
| 073662   | Magneto distributor block thumb nut..                | 6   |
| 073664   | Magneto distributor carbon brush and<br>spring ..... | 33  |
| 073665   | Magneto distributor disc .....                       | 10  |

**MOTOR SUPPORT**

(None)

**MOTOR VALVE**

|        |   |    |
|--------|---|----|
| 56669  | Motor valve .....   | 12 |
| 408501 | Motor valve roller and guide assembly                       | 10 |
| 21423  | Motor valve roller and holder screw..                       | 5  |
| 3020   | Lock nut .....  | 5  |
| 404141 | Motor valve roller holder tube and<br>roller assembly ..... | 6  |
| 50725  | Motor valve spring .....                                    | 2  |
| 58431  | Motor valve spring collar.....                              | 4  |
| 59214  | Motor valve spring collar key.....                          | 8  |

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**LIST OF SPARE PARTS****MOTOR WATER PUMP**

| Part No. | Name   | "A" |
|----------|--|-----|
| 60455    | Motor water pump inlet elbow.....                        | 1   |
| 43034    | Motor water pump inlet elbow gasket.                     | 4   |
| 55073    | Motor water pump inlet manifold hose                     | 4   |
| 25244    | Motor water pump inlet manifold hose<br>clamp .....      | 2   |
| 37710    | Motor water pump shaft gland, large..                    | 1   |
| 60457    | Motor water pump shaft gland, small..                    | 1   |
| 55054    | Motor water pump shaft gland bushing                     | 2   |
| 51369    | Motor water pump shaft gland bushing<br>lock screw ..... | 4   |
| 37712    | Motor water pump shaft gland nut....                     | 2   |
| 55094    | Motor water pump shaft gland packing                     | 50  |

**CLUTCH**

|        |  |    |
|--------|--|----|
| 70223  | Clutch casing plate assembly.....                                    | 7  |
| 447221 | Clutch shifter trust bearing sleeve<br>grease cup tube assembly..... | 10 |



**STEERING**

(None)

**STEERING KNUCKLES**

| Part No. | Name  | "A" |
|----------|---|-----|
| 58249    | Steering knuckle pin .....                        | 2   |
| 3596     | Nut .....   | 2   |
| 59266    | Steering knuckle cone and rollers in-board .....  | 1   |
| 59267    | Steering knuckle cone and rollers out-board ..... | 1   |
| 24234    | Wheel hub bearing-front cup inboard..             | 1   |
| 59269    | Wheel hub bearing-front cup outboard.             | 1   |

**FRAME**

(None)

**FOOT BRAKE**

|       |  |     |
|-------|--|-----|
| 58388 | Foot brake actuating lever .....                   | 1   |
| 58389 | Foot brake actuating lever pin.....                | 2   |
| 56338 | Foot brake actuating lever retract-spring .....    | 1   |
| 56340 | Foot brake adjusting yoke end, male..              | 1   |
| 41455 | Foot brake adjusting yoke end, female              | 3   |
| 56330 | Foot brake block connecting rod.....               | 1   |
| 56331 | Foot brake block connecting rod stop.              | 1   |
| 56332 | Foot brake block connecting rod trunnion .....     | 1   |
| 56333 | Foot brake block connecting rod trunnion pin ..... | 1   |
| 56334 | Foot brake block connecting rod wing nut .....     | 2   |
| 57427 | Foot brake pedal retracting spring....             | 2   |
| 58400 | Foot brake shoe lining .....                       | 10  |
| 4368  | Rivet .....  | 120 |

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Varying from "A" as minimum to three times "A" as maximum.

**LIST OF SPARE PARTS****TRANSMISSION**

| Part No. | Name  | "A" |
|----------|---|-----|
| 59540    | Transmission case cover gasket.....                     | 3   |
| 64017    | Transmission case front end gasket....                  | 3   |
| 20073    | Transmission case front end oil drain plug .....        | 1   |
| 20075    | Transmission case front end oil drain plug gasket ..... | 3   |

| Part No. | Name  | "A" |
|----------|---|-----|
| 22075    | Transmission case oil filler plug gasket                              | 3   |
| 20162    | Transmission first and second speed pinion .....                      | 2   |
| 20106    | Transmission gear shifter fork.....                                   | 1   |
| 20104    | Transmission gear shifter fork shaft                                  | 1   |
| 20107    | Transmission gear shifter lock.....                                   | 1   |
| 20111    | Transmission gear shifter lock plunger                                | 1   |
| 20109    | Transmission gear shifter lock spring                                 | 2   |
| 20110    | Transmission gear shifter lock spring adjuster .....                  | 2   |
| 591731   | Transmission reversing pinion and bushing assembly .....              | 2   |
| 20250    | Transmission reversing toggle link...                                 | 2   |
| 20249    | Transmission reversing toggle link tapped .....                       | 2   |
| 50090    | Transmission reversing toggle link threaded .....                     | 2   |
| 40858    | Transmission reversing toggle link pin, long .....                    | 4   |
| 20251    | Transmission reversing toggle link pin, short .....                   | 4   |
| 50089    | Transmission reversing toggle lever inside .....                      | 2   |
| 343911   | Transmission reversing toggle lever (outside) and spring stud ass'y.. | 2   |
| 20238    | Transmission reversing yoke.....                                      | 1   |
| 20239    | Transmission reversing yoke stop screw                                | 4   |

**BONNET**

(None)

**CHANGE SPEED**

(None)

**HAND BRAKE**

|        |   |   |
|--------|---|---|
| 600261 | Hand brake connecting rod-rear ass'y                  | 4 |
| 60030  | Hand brake connecting rod-rear trunion .....          | 4 |
| 60031  | Hand brake connecting rod-rear trunion pin .....      | 4 |
| 60032  | Hand brake connecting rod-rear trunion wing nut ..... | 4 |
| 60033  | Hand brake intermediate lever-inboard                 | 1 |
| 60034  | Hand brake intermediate lever-outboard .....          | 1 |

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## LIST OF SPARE PARTS

## GASOLINE

| Part No. | Name   | "A" |
|----------|--|-----|
| 0659931  | Gasoline hand pressure pump handle<br>and plunger assembly ..... | 2   |
| 065995   | Gasoline hand pressure pump piston<br>rod .....                  | 1   |
| 065996   | Gasoline hand pressure pump piston<br>leather .....              | 10  |
| 065997   | Gasoline hand pressure pump piston<br>nut .....                  | 2   |
| 044149   | Gasoline hand pressure pump piston<br>rod handle .....           | 2   |
| 044150   | Gasoline hand pressure pump piston<br>rod handle nut .....       | 2   |
| 066001   | Gasoline hand pressure pump piston<br>rod handle sleeve .....    | 2   |
| 41667    | Gasoline hand gauge .....  | 2   |
| 213971   | Gasoline tank drain cock ass'y.....                              | 2   |
| 232981   | Gasoline tank inlet strainer ass'y.....                          | 2   |
| 54814    | Gasoline tank outlet tube tee.....                               | 2   |
| 070911   | Gasoline tank valve and lever ass'y...                           | 1   |
| 605881   | Gasoline tube ass'y .....  | 1   |

## RADIATOR

|        |   |    |
|--------|---|----|
| 606941 | Radiator ass'y .....                                    | 1  |
| 60708  | Radiator outlet flange .....                            | 1  |
| 213971 | Radiator outlet flange drain cock ass'y                 | 3  |
| 61040  | Radiator outlet flange gasket.....                      | 6  |
| 60723  | Radiator side support bracket pin....                   | 2  |
| 60731  | Radiator to water pump hose.....                        | 6  |
| 25244  | Radiator to water pump hose clamp..                     | 3  |
| 53202  | Radiator to water pump hose stiffener                   | 6  |
| 59657  | Motor cylinder to radiator hose.....                    | 6  |
| 073676 | Magneto distributor stud nut with<br>spring .....       | 3  |
| 073667 | Magneto distributor block clamp.....                    | 3  |
| 073668 | Magneto gap protector .....                             | 3  |
| 073690 | Magneto winding .....                                   | 3  |
| 72670  | Switch board ignition coil (Dixie)...                   | 2  |
| 074110 | Switch board ignition coil contact<br>screw .....       | 6  |
| 974144 | Switch board ignition vibrator spring<br>assembly ..... | 12 |

## ACCELERATOR

(None)

## CAM SHAFT

(None)

**CARBURETOR**

| Part No. | Name                                | "A" |
|----------|-------------------------------------|-----|
| 561661   | Motor carb. air valve assembly..... | 3   |
| 55600    | Motor carb. air valve adj. nut..... | 3   |
| 3148     | Lock nut .....                      | 6   |
| 5500     | Washer .....                        | 6   |

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**LIST OF SPARE PARTS****CARBURETOR—Continued**

|       |  |   |
|-------|--|---|
| 57680 | Motor carb. air valve seat gasket.....   | 6 |
| 4473  | Motor carb. air valve seat screw.....    | 6 |
| 55601 | Motor carb. air valve seat spring, large | 3 |
| 46947 | Motor carb. air valve seat spring, small | 2 |
| 5441  | Motor carb. body hot water tube union    | 2 |

**CARBURETOR FLOAT**

|        |   |   |
|--------|---|---|
| 210581 | Motor carb. float assembly.....                             | 2 |
| 56163  | Motor carb. float chamber drain plug                        | 1 |
| 56164  | Motor carb. float chamber plug cap...                       | 1 |
| 210191 | Motor carb. float chamber filter well<br>assembly .....     | 2 |
| 20075  | Motor carb. float chamber filter well<br>gasket .....       | 2 |
| 21049  | Motor carb. float chamber needle valve                      | 4 |
| 44712  | Motor carb. float chamber needle valve<br>cap .....         | 2 |
| 21050  | Motor carb. float chamber needle valve<br>collar .....      | 2 |
| 21051  | Motor carb. float chamber needle valve<br>seat .....        | 4 |
| 459033 | Motor carb. float chamber needle valve<br>seat gasket ..... | 4 |
| 603331 | Motor carb. float chamber vent tube<br>assembly .....       | 2 |
| 53321  | Motor carb. spray mixing tube.....                          | 3 |
| 5328   | Motor carb. spray mixing tube screw<br>B. P. ....           | 6 |
| 371841 | Motor carb. spray tube assembly.....                        | 3 |
| 45933  | Motor carb. spray tube gasket.....                          | 2 |
| 51391  | Motor carb. to water pump cock.....                         | 3 |

**CONNECTING ROD**

|         |  |   |
|---------|--|---|
| 0481551 | Motor connecting crank shaft bushing<br>assembly ..... | 8 |
|---------|--|---|



**CRANK CASE**

| Part No. | Name                                   | "A" |
|----------|--|-----|
| 60355    | Motor crank case gasket, right.....    | 4   |
| 60354    | Motor crank case gasket, left.....     | 4   |
| 20073    | Motor crank case oil gasket hole plug. | 1   |
| 20075    | Motor crank case oil hole plug gasket  | 6   |
| 478021   | Motor crank case overflow valve ass'y  | 1   |
| 5421     | Motor crank case lower half pipe plug  | 4   |

**CYLINDER**

|       |  |   |
|-------|--|---|
| 48563 | Motor cylinder pet cock.....                         | 4 |
| 42451 | Motor cylinder pet cock connection...                | 4 |
| 19455 | Motor cylinder top plug gasket.....                  | 6 |
| 62020 | Motor cylinder valve chamber plug ex-<br>haust ..... | 3 |
| 62019 | Motor cylinder valve chamber plug<br>inlet .....     | 3 |

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**LIST OF SPARE PARTS**

| Part No. | Name   | "A" |
|----------|--|-----|
| 56677    | Motor cylinder valve chamber plug<br>gasket .....              | 50  |
| 60675    | Motor cylinder water chamber cover<br>gasket .....             | 2   |
| 61040    | Motor cylinder water chamber cover<br>outlet elbow gasket..... | 2   |
| 40429    | Motor cylinder water inlet manifold<br>gasket .....            | 2   |

**FAN**

|        |  |    |
|--------|--|----|
| 630951 | Motor fan assembly .....                           | 1  |
| 44146  | Motor fan adjuster .....                           | 1  |
| 22016  | Motor ball bearing, front.....                     | 1  |
| 22018  | Motor fan ball bearing, rear.....                  | 1  |
| 22008  | Motor fan bearing spindle.....                     | 2  |
| 22011  | Motor fan bearing spindle lock.....                | 2  |
| 22010  | Motor fan bearing spindle nut.....                 | 4  |
| 60382  | Motor fan belt .....                               | 25 |
| 59005  | Motor fan belt screw.....                          | 20 |
| 3002   | Nut .....  | 20 |
| 3905   | Washer .....                                       | 20 |
| 42109  | Motor fan driving pulley bearing....               | 1  |
| 44739  | Motor fan driving pulley bearing gas-<br>ket ..... | 2  |
| 5502   | Lock washer .....                                  | 6  |
| 51199  | Motor fan driving pulley nut.....                  | 1  |
| 548377 | Motor fan driving pulley nut gasket..              | 1  |
| 51200  | Motor fan driving pulley nut set screw             | 2  |

## FLY WHEEL

(None)

## MOTOR GEARS

(None)

## GOVERNOR

| Part No. | Name  | "A" |
|----------|---|-----|
| 60390    | Motor governor ball .....                                 | 2   |
| 60392    | Motor governor ball carrier bushing..                     | 1   |
| 3109     | Motor governor ball carrier retaining<br>nut .....        | 1   |
| 60393    | Motor governor ball pin.....                              | 2   |
| 60394    | Motor governor ball spring.....                           | 2   |
| 604041   | Motor governor housing cover ass'y..                      | 1   |
| 60406    | Motor governor plunger .....                              | 1   |
| 60409    | Motor governor plunger pin.....                           | 1   |
| 60410    | Motor governor plunger spring.....                        | 2   |
| 60411    | Motor governor plunger spring seat...                     | 1   |
| 60412    | Motor governor plunger spring seat<br>adjusting nut ..... | 1   |
| 60413    | Motor governor shaft .....                                | 1   |
| 60415    | Motor governor shaft end.....                             | 2   |
| 60416    | Motor governor shaft pin.....                             | 2   |
| 4111     | Motor governor shaft pin lock screw..                     | 2   |

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## LIST OF SPARE PARTS

## OIL MANIFOLD &amp; OIL PUMP

| Part No. | Name   | "A" |
|----------|--|-----|
| 604191   | Motor oil manifold to press-gauge tube<br>assembly ..... | 1   |
| 66946    | Motor oil pressure gauge.....                            | 1   |
| 073261   | Motor oil pressure gauge glass.....                      | 2   |
| 4954     | Wood screw .....   | 6   |
| 620761   | Motor oil pump assembly.....                             | 1   |
| 57681    | Motor oil pump body gasket.....                          | 3   |
| 61812    | Motor oil pump to crank case stud, long                  | 3   |
| 60420    | Motor oil pump driving shaft, inter-<br>mediate .....    | 2   |
| 60421    | Motor oil pump outlet tube elbow....                     | 1   |
| 604231   | Motor oil pump outlet tube front<br>assembly .....       | 1   |
| 604251   | Motor oil pump outlet tube rear<br>assembly .....        | 1   |

| Part No. | Name  | "A" |
|----------|---|-----|
| 57445    | Motor oil pump outlet tube union....                          | 1   |
| 57096    | Motor oil pump outlet tube union<br>gasket .....              | 2   |
| 62002    | Motor oil pump strainer cover gasket                          | 2   |
| 618231   | Motor oil pump strainer and rein-<br>forcement assembly ..... | 1   |
| 223231   | Motor oil strainer assembly.....                              | 1   |
| 53326    | Motor oil strainer gasket .....                               | 4   |
| 57576    | Motor oil strainer housing gasket.....                        | 2   |

### PISTON

(None)

### STARTING CRANK

|        |   |   |
|--------|---|---|
| 60430  | Motor starting crank hanger spring..                        | 2 |
| 510791 | Motor starting crank shaft clutch<br>housing assembly ..... | 4 |
| 57697  | Motor starting crank shaft housing<br>gasket .....          | 6 |
| 23754  | Motor starting crank clutch pin.....                        | 3 |

### STEERING

(None)

### UNIVERSAL

|       |   |    |
|-------|---|----|
| 20821 | Universal joint dust cover ass'y<br>(leather) ..... | 6  |
| 22699 | Universal joint front collar ass'y.....             | 1  |
| 5422  | Universal joint front collar plug.....              | 10 |
| 20784 | Universal joint front end.....                      | 1  |
| 24483 | Universal joint shaft front bumper....              | 6  |
| 20788 | Universal joint shaft front block.....              | 4  |
| 20789 | Universal joint shaft front pin.....                | 2  |

### SPRINGS

#### These Three Items To Be Wrapped in Burlap

|         |  |   |
|---------|--|---|
| 582611  | Steering conn. rod ass'y.....          | 1 |
| 0652101 | Front axle spring and bushing ass'y..  | 3 |
| 0652111 | Rear axle spring and bushing ass'y.... | 2 |

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## LIST OF SPARE PARTS

## SPRINGS—Continued

| Part No. | Name   | "A" |
|----------|--|-----|
| 58982    | Front axle spring pin front right.....                     | 1   |
| 58983    | Front axle spring pin front left.....                      | 1   |
| 58984    | Front axle spring pin rear.....                            | 2   |
| 25124    | Front axle spring clip saddle.....                         | 1   |
| 59356    | Front axle spring clip nut.....                            | 4   |
| 5520     | Lock washer .....  | 6   |
| 5518     | Lock washer .....  | 6   |
| 59002    | Rear axle spring clip nut.....                             | 4   |
| 59003    | Rear axle spring pin .....                                 | 2   |
| 073488   | Front axle spring rebound clip long...                     | 4   |
| 076962   | Front axle spring rebound clip long<br>bolt and nut .....  | 4   |
| 35431    | Front axle spring rebound clip short..                     | 4   |
| 070964   | Front axle spring rebound clip short<br>bolt and nut ..... | 4   |
| 073490   | Rear axle spring rebound clip long..                       | 4   |
| 058490   | Rear axle spring rebound clip long<br>bolt and nut .....   | 4   |
| 073489   | Rear axle spring rebound clip short..                      | 4   |
| 058492   | Rear axle spring rebound clip short<br>bolt and nut .....  | 4   |

## OILER AND GREASE CUPS

|       |   |    |
|-------|---|----|
| 22898 | Motor fan bearing grease cup.....                 | 2  |
| 20259 | Motor support beam pin oiler.....                 | 6  |
| 59008 | Clutch pedal shaft oiler.....                     | 12 |
| 26687 | Clutch shaft bearing grease cup.....              | 6  |
| 20711 | Clutch shifter thrust bearing grease<br>cup ..... | 3  |
| 22656 | Steering knuckle cap oiler.....                   | 4  |
| 58985 | Front axle spring pin oiler.....                  | 12 |
| 24124 | Front axle spring pin oiler elbow.....            | 12 |
| 26686 | Steering worm wheel grease cup.....               | 4  |

## SWITCH BOARD

|       |                                      |   |   |
|-------|--------------------------------------|---|---|
| 60891 | Switchboard control hand lever ass'y | 6 | 3 |
|-------|--------------------------------------|---|---|

## TOOL EQUIPMENT

|       |   |   |
|-------|---|---|
| 22120 | Oil can (with long spout).....                  | 3 |
| 24343 | Tool box hammer 1¼ lb. ....                     | 1 |
| 22920 | Tool box hammer ¾ lb. ....                      | 1 |
| 22104 | Tool box pliers.....                            | 2 |
| 46703 | Tool box double head wrench 11/16<br>x 1¼ ..... | 2 |
| 46704 | Tool box double head wrench 15/16<br>x 1 .....  | 2 |
| 46705 | Tool box double head wrench ¾ x 7/8             | 2 |



| Part No. | Name   | "A" |
|----------|--|-----|
| 46706    | Tool box double head wrench 15/16<br>x 5/8 ..... | 2   |
| 46707    | Tool box double head wrench 7/16<br>x 1/2 .....  | 2   |
| 47669    | Tool box double head wrench 1/4<br>x 5/16 .....  | 2   |
| 22103    | Tool box screw driver 6" blade.....              | 2   |
| 55505    | Tool box screw driver 3" blade.....              | 2   |
| 621481   | Tool box equipped.....                           | 1   |

Varying from Zero for Light Service to Twice "A" for Severe Field Service.

Determined by condition of service, accessibility of base and consideration of weight and space.

Varying from "A" as minimum to three times "A" as maximum.

LIST OF SPARE PARTS

HAND BRAKE BLOCK

| Part No. | Name                      | "A" |
|----------|---------------------------|-----|
| 57987    | Hand brake cam lever..... | 2   |

REAR AXLE

|       |   |    |
|-------|---|----|
| 58976 | Rear axle brace rear end pin oiler ex-<br>tension ..... | 20 |
| 69834 | Rear axle case oil hole plug.....                       | 2  |
| 47587 | Rear axle case oil hole plug gasket...                  | 6  |
| 58022 | Rear axle shaft oil hole.....                           | 2  |
| 58029 | Rear axle shaft driving ring plate<br>bolt key .....    | 6  |

DIFFERENTIAL

|       |   |   |
|-------|---|---|
| 57970 | Differential driving worm thrust bear-<br>ing .....     | 2 |
| 57971 | Differential driving worm thrust bear-<br>ing cup ..... | 1 |
| 57972 | Differential driving thrust bearing cap<br>gasket ..... | 6 |

TOQUE ARM  
(None)

WHEELS

|       |  |   |
|-------|--|---|
| 59024 | Wheel hup cap and odometer front-<br>right ..... | 1 |
|-------|--|---|

Varying from Zero for Light Service to Twice "A" for Severe Field Service.

Determined by condition of service, accessibility of base and consideration of weight and space.

Varying from "A" as minimum to three times "A" as maximum.

## MARKING AND STENCILLING

(See A. R. 295)

**Individual Equipment.**—All articles of personal and truck equipment will be plainly marked with the numerical designation of the company, as prescribed by existing regulations of the War Department.

Each member of the company will be assigned a number and each article of personal or unit equipment issued to an individual will be marked with the number assigned to him.

**Company Equipment.**—All articles of general equipment will be plainly marked with the company designation. The letters in marking articles of personal, unit or general equipment. Example of marking as follows:

## CO. "A," 301ST SUPPLY TRAIN

The number assigned to the individual to whom equipment is issued will be placed below the Co. A 301st Supply Train.

All marks will be neatly stencilled in black, using standard stencil for this purpose. Marking with ink, indelible pencil, etc., by individuals is strictly prohibited, and the value of the articles so mutilated will be charged to the individual.

Articles of equipment which cannot be marked by stenciling will be stamped with a steel die, a set of which is included in each company equipment.

**Trucks and Truck Equipment.**—Motor trucks will be numbered as follows: the first number or numerals, will indicate the number of the company. Vehicles will be numbered serially from 1 to 32, example:

All cargo trucks from 01 to 27 inclusive  
 Repair car 28  
 Baggage and ration Truck 29  
 Gasoline carrying trucks 30 to 31  
 Company Commander's car 32,.

All trucks will be marked on the second panel from rear end on each side, as shown by the following example. Block letters 3 inches high: "301 Sp. Tn." Then, immediately below, in block letters 10 inches high, the number of the truck Co. 4, No. 01 back part of truck number 1¼ inches thick.

On the front of the truck, the upper part of the dash will be stencilled as follows:

|   |     |    |   |
|---|-----|----|---|
| U | Co. | A  | Q |
| S | Sp  | Tn | M |
| A | 301 |    | C |

Block letters 2½ inches high; block figures 10 inches high; black part 1¼ inches thick.

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N. B. \* Present markings will not be disturbed until companies are reorganized.

The tail gate will be stencilled with the number of the truck Co. A, No. 01 in block letters, 19 inches high, black part 1¼ inches thick.

Truck covers will be stencilled on right and left side, in letters 3 inches high, as follows: Co. A, No.-01.

The following data will be placed in successive lines on the rear panel on right side of body, in letters 1 inch high, as follows:

• Weight .....lbs.  
Ins. body .....ft.  
Ht. at bow .....ft.  
Capacity .....lbs.  
Put way bills below.

Underneath this last line, the panel will be printed in black slate paint. The portion of the panel so painted should be 10 inches high.

Roadster will carry a number plate on the front and rear, of sufficient size to permit block numbers 6½ inches high, to be used, and will be marked as follows:

U Co. A Q  
S 301 M  
A Sp Tn C

Block letters 2 inches high, block number 6½ inches high.

On each door panel of each company commander's car, in block letters 3 inches high as follows:

CO. "A," 301ST SUPPLY TRAIN

All equipment pertaining to Motor Truck Companies will be marked with the number of the company.

As the plate bearing the manufacturer's serial number is not securely fastened to the truck, the serial number of a truck is often lost, causing a great deal of inconvenience thereby. To prevent trouble of this nature, both the manufacturer's serial number and the motor number of the truck will be stencilled in black paint on the right side member of the frame of the chassis near the forward end of the frame. Clear cut one-inch stencils will be used for this purpose and numbers will be put on as follows:

S. No. ....  
M. No. ....

Company commanders will personally verify both serial and motor number as thus painted on chassis, and should the motor of a truck be changed, the new number will replace that on the chassis, and a note thereof made in the proper company record.

### M. SALVAGE

Salvage Departments for the systematic recovery of all possible values from broken, defective worn out or obsolete material arising from the repair of motor equipment of all kinds have been established and officers are charged with forwarding to this park all worn out broken or defective material which may accumulate at their stations.

All solid tires installed on motor vehicles and trailers will be continued in use until the rubber is worn to within one-half-inch above the steel channel of the tire. All trimmings from these tires will be carefully preserved and turned in to the Salvage Department.

Tires which have been thrown off from the steel channels before the tire is worn out will be preserved with a view of their exchange, as throwing off under the conditions cited above is an indication of defect in the tire, which normally calls for replacement by the manufacturer. Tires discarded under this paragraph will be tagged with the amount, approximately, of mileage gotten from them up to date of removal and forwarded to the Salvage Department for necessary adjustment. Sheet iron automobile bodies which are bulky should not be sent in.

### N. SAFEGUARDING SMALL ARMS

Rifle arm lockers only will be issued to organizations for the safe keeping of small arms. Officers who are responsible for small arms and who neglect to obtain these lockers will be regarded as not having taken reasonable precaution to prevent such loss.

When troops are operating in the field, responsible officers are not required to take arm racks or arm lockers with them for the safe keeping of small arms, unless it is convenient to do so; but a system will be devised in the organization which will provide reasonable precautions for the safekeeping of arms under the particular field conditions to which the troops are subjected. When the troops operating in the field are required to be armed at all times, each individual will be held responsible that he takes reasonable precautions for the safekeeping of arms issued to him. When, for any reason, troops so operating are not permitted to be armed at all times, responsible officers will have the arms safeguarded under conditions that will provide reasonable precautions for their safekeeping. When arm racks or arm lockers are not available, arms will be safeguarded when not in actual possession of officers and enlisted men.

### O. REQUISITIONS, ACCOUNTABILITY, RESPONSIBILITY

Requisitions will be submitted by truck company commanders, to the Train Supply Officer or where it is operating separately through the officer in charge of motor transportation at the



station where they may be serving, and where no officer has been so designated, through the quartermaster of the station or district to which the company is assigned to duty.

Requisitions must be made on the proper form prescribed by each department by which the articles specified are supplied, and will be accounted for by the Supply Officer or by truck company commander where company is operating separately in the manner prescribed by Army Regulations for accountability of property.

Requisitions for spare parts for motor propelled vehicles will bear on the face of the requisition a statement showing the number of each article that is needed for immediate repairs and the number that is wanted for stock.

Articles lost, damaged, or destroyed, by carelessness or lack of proper care on the part of the individual to whom issued, or who is responsible therefor, will be charged to the individual, and the value thereof deducted from any pay or allowance which may be due at the time of next payment.

Articles which are worn out by fair wear and tear, or lost under circumstances which indicate that there was no carelessness or neglect on the part of the person responsible therefor, will be accounted for by survey, as prescribed in Army Regulations.

Officers in command of truck companies are cautioned that proper care, supervision, and frequent inspection of articles of equipment will be required of them. They will also be held to a strict accountability for the proper care of all articles of equipment. The provisions of the Army Regulations in regard to care and accountability for property will be enforced.

When an officer is relieved from command of a truck company, or is temporarily absent therefrom, he will transfer to his successor, or to the officer temporarily designated to relieve him, all articles of equipment for which he is accountable or responsible, and such transfer will be strictly in accordance with provisions of Army Regulations and orders of the War Department.

Attention is invited to provisions of law and regulations that *only* commissioned officers of the regular Army, or U. S. Volunteers, or Militia, duly mustered into the service of the United States, are authorized to hold or account for Government property.

## CHAPTER VI

### THE OPERATION OF A MOTOR TRUCK COMPANY

#### Part 1

#### FORMATIONS

The formations required of a truck company may be classed generally as formations for road, park and inspection.

**Road Formations.**—The normal road formation is column of trucks, with fourteen yards distance between trucks, giving the truck company a road space of 800 yards. The distance between trucks may be increased or decreased at the discretion of the Company Commander according to conditions of the march. When conditions permit, distances will be habitually increased. The distance between trucks should never be less than one truck length, and then only for very slow rates of speed. When the company halts, trucks close up to one yard distance without command before halting.

**Park formations.**—The company may be parked either in line, double line, column of sections, or exceptionally in column or corral:

1. Line.—Trucks are in line normally with 2 yards interval between trucks. A greater or less interval may be ordered by the company commander according to parking space available.

2. Double line.—Trucks are formed in two lines, trucks facing each other, with a distance of 1 yard between radiators of opposite trucks, and 2 yards interval between adjacent trucks. A greater or less interval may be ordered by company commander. This is the preferable parking method for permanent camp or in such places where space or tactical situation permits. In this formation the trucks are easily accessible from all sides for work, and the motors being together on either side of a central line enables the mechanics to more easily superintend the repair work, as the greater amount that they are called upon to perform pertains to the motor and forward end of chassis.

3. Column of sections.—Sections are in line, with interval of 2 yards between trucks, and distance of 14 yards between sections. These distances and intervals may be varied at the discretion of the company commander.

4. Column or corral.—(a) Column: This method of parking is used only where sufficient lateral space is not available for one of the other formations. This would be the case when the company is in bivouac along a road not permitting a line formation. In this case, the distance between trucks should be reduced to a minimum, not over 1 yard at the most. (b) Corral: The trucks may be parked so as to form a closed corral for defense.

This is an exceptional method and very rarely resorted to.  
(c) Formation for inspection: The formation for inspection will be either in line or in column of sections. Interval between trucks 2 yards. Distance between sections 14 yards.

### Inspection

Position of "Prepare for inspection": Men will stand at attention, driver one foot from front fender on side of driver's seat and on a line with the front of the radiator. Assistant Truckmaster in a corresponding position to the driver but on the opposite side of the right truck in section.

Assistant chauffeurs and mechanics in a position corresponding to that of the driver but on the opposite side of the trucks in which they ride. Truckmasters in line on the right of the rank. Company Commander one yard in front of his roadster.

Bonnets of all trucks and automobiles will be raised so as to expose the motor. All articles of equipment will be laid out so that the company stencils are plainly visible.

All truck equipment will be laid out in a uniform manner on the ground alongside of tool box.

Articles of personal equipment will be laid on the shelter half, rear of the shelter half being one yard in front of the radiator, and in front of each individual. All tool boxes or other receptacles will be open to show interior. Seat cushions will be raised to expose under side.

## Part 2

### INFANTRY WORK IN THE FIELD

#### Dismounted Instruction

The Company, without truck equipment, marches and manoeuvres by the methods and means prescribed in the Infantry Drill Regulations, 1911. Every effort will be seized by Company Commanders to give their men instruction in the "School of the Soldier" and "School of the Squad." (I.D.R. par. 48 to 158). Members of motor truck companies are soldiers before they are anything else, and officers must not lose sight of this fact.

#### Small Arms Practice

**Instruction.**—When conditions permit, instruction will be given each day to such men as are available in the care and use of the rifle and pistol, as outlined in pars. 1 to 70 (Chapters 1 to 111 inclusive) Small Arms Firing Manual, 1913. This instruction will be continued until all men are proficient, and thereafter given at such intervals that when opportunity presents itself for range practice, the company will be prepared.

**Equipment.**—With this in view, each company will provide itself with the following equipment, towit:

One sighting bar—Pa. 16, S.A.F.M.

Two Sighting Rests for Rifle, etc. Pa. 17 S.A.F.M.

**Instructors.**—At least two non-commissioned officers, especially qualified, will be detailed for this duty and will, under the direct supervision of the Company Commander, act as instructors of the company.

Officers will impress upon their men that thorough and constant practice in preliminary instruction and pointing and aiming drills are the basis of successful military shooting.

### Part 3

## VISUAL AND WHISTLE SIGNALS

**“Attention.”**—One long blast of whistle. Drivers retard spark, set throttle and air control, then stand at attention one foot from front fender on side of driver's seat, and on line with front of radiator; eyes in direction of section master. Assistant drivers and mechanics in corresponding position on opposite side of trucks on which they ride. Assistant truckmaster three yards in front of center of his section, if in line; three yards in front and one yard on right of flank of his section, if in column. Truckmaster six yards in front of center of company if in line; six yards in front and one yard to right of flank leading truck if in column. Company Commander one yard in front of truckmaster.

**“Start Motors.”**—Make a circular motion in front of body with right hand and arm, simulating the operation of cranking the motor. Drivers turn on spark and crank motor: as soon as motor runs, replace crank to running position, advance spark, and take position in drivers seat, keeping eyes on section master. Mechanics and spare drivers take their seats at same time as drivers. Each assistant truckmaster faces his section until the motors therein are in running, and then faces about and looks toward the truckmaster.

**“Stop Motors.”**—Extend right arm laterally to horizontal position, and then move same down several times. Each driver stops his motor. Assistant truckmasters descend and take positions where they can see signals given by Company Commander.

**“Forward.”**—Carry the hand to the shoulder, straighten and hold the arm horizontally thrusting it in the direction of march. In moving out from line or column, trucks follow each other at distance of fourteen yards (two trucks length). This is the normal distance for a moving column unless otherwise specified in command.



**"Halt."**—Hold arm fully extended in vertical position as in I.D.R. When column is halted, trucks close up to distance of one yard.

**"Forward."**—2 short blasts of whistle.

**"Halt."**—1 long blast of whistle.

**"Backward."**—3 short blasts of whistle.

**"Change Direction."**—Bring the hand to the shoulder and thrust the arm in the direction desired.

**"Chains On."**—Raise both hands above the head, fingers touching, thus forming a circle.

**"Chains Off."**—Raise both hands as in chains on, then bring arms, fully extended, to the horizontal position. Repeat several times.

Complicated signals are difficult to observe and should be discouraged. Rear trucks conform to the movements of those in front, the drivers watching their leaders carefully for indications as to contemplated movements.

#### Part 4

### ROAD ROUTINE AND MARCHING

**Order of March.**—The order of sections in column should ordinarily alternate daily. The repair car should be in rear of train, the kitchen car being in front. It is sometimes advisable to have one of the gasoline carrying trucks in the center of the train, but there should always be at least one at the rear, immediately in front of the repair car. Cooks and mess sergeants ride well towards the head of the train in order to start preparing the meal on arrival at camp. The Company Commander rides wherever he judges his presence necessary, but it is especially in rear that he will be best placed to render his supervision efficient. The Truckmaster rides wherever the judgment of the Company Commander dictates. The assistant truckmasters ride in the various trucks of their sections where they can most efficiently conduct the operation of their sections. The chief mechanic rides in the repair car. The assistant mechanics may ride either on the repair car or may be placed on trucks in the two forward sections of the train.

Where the whole Supply Train is operating as a unit, the motor ambulance will ordinarily march as the last vehicle in the train. The Medical department motor-cycles and side-cars will march as directed by the surgeon.

**Distance between Vehicles.**—Except on very dusty roads; those with heavy grades, and when road space is unimportant, where greater distances may be taken, the vehicles should be about fourteen yards apart. Due to variations in mechanism and

skill of drivers, different vehicles do not ascend slopes at same speed, therefore, these distances will vary, but the leading vehicle should normally slow down after climbing a slope so that the train will not spread out too much. In some cases, after climbing or descending a difficult slope, the leading vehicle should stop to allow the train to close up.

**Rate of March.**—This depends on condition of road, the amount and nature of cargo carried as well as on other incidents of the march. The leading truck should rarely take the maximum authorized speed, as trucks in rear will have to exceed that speed. The speed should be as regular as possible, that all trucks may keep their distances without speeding. Never allow individual trucks to exceed authorized speed limit.

**March Discipline.**—Vehicle must always keep well on the right of the road. This is especially necessary in operating on roads in field service, and must be rigidly enforced. The driver of each truck, personally or through his assistant chauffeur, should keep in touch with the trucks in rear, so that if any halt is made, he do likewise and give proper signal to trucks in front. Under no circumstances should a train spread out on the road, nor should individual drivers exceed the speed limit in catching up with the car ahead. This should be a constant preoccupation of all in authority in the company. If a truck stops, the entire train should stop. The Company Commander, or the truckmaster if so authorized, should ascertain the time required for the repair and nature of same. The Company Commander will promptly decide whether to halt the train until the repair is completed, leave the truck and sufficient personnel to make repair to later rejoin train, tow the truck, or to shift load and abandon truck. This decision will depend on the nature of the duty on which train is engaged, the distance to new camping place, or the urgency of the duty on which train is engaged. The Company Commander in deciding such cases, must remember that "service" is the mission of the company, and that it is no disgrace to abandon a truck whose mechanism has broken down. This point of service is one that the Company Commander should constantly bear in mind, as his subordinates are generally more interested in the mechanism of the truck, and are apt to lose sight of the purpose of the train, in their interest in the mechanism or in "demonstrating" the perfection of the particular type of truck assigned to the train.

No truck should be allowed to pass ahead of another without express order of the Company Commander. If a truck halts, all in rear will halt, and will not move ahead unless ordered by competent authority. The company will not pass a column marching in same direction without agreement with the Commander of that column. The senior officer of the units will decide the action to be taken. If the truck company is to pass, it is preferable for the other column to halt during the passage, especially if composed of marching troops. The same rules

hold in case the company crosses in line of march of another column.

**Road Difficulties.**—These are due to the nature of the road surface, the grades or natural obstacles encountered.

In muddy roads, it will be necessary to use chains on the traction wheels. If they are not sufficient, build a suitable track for wheels by utilizing any material available, such as brush, grass, etc. It is often advantageous to carry planks on the truck about 10 feet long and 4 inches thick and 6 or 8 inches wide, or pieces of 2x4 inch lumber, to place under wheel, between tires, to enable wheel to get sufficient traction. In case a truck has gotten across a mud hole safely, it is advisable to attach a sufficient long towing line to the other trucks and haul them through by utilizing the truck working on hard ground. Similarly, it will often be necessary to haul a truck out of mud or sand in the same way. A handy substitute for the towing cable is a piece of 3-inch pipe about 10 feet in length made with suitable clevis on each end, and to be used for both pushing and towing.

Do not let truck wheels revolve uselessly, as that simply serves to dig it in deeper. In getting trucks through sand or mud, the greater part depends on the practical genius of the members of the company.

In going up steep grades, or crossing streams, be careful to keep trucks far apart, to avoid any possible accident. A similar condition exists with reference to descending steep slopes. Brakes should not be relied on, but the gear should be set in a low speed and the motor used as a brake, to prevent burning out of brake bands.

Hold a driver pecuniarily responsible for having his radiator smashed by collision. When crossing a railroad track at a grade crossing, or at any other dangerous place, station a man during the entire passage of the trucks to insure the safety of all vehicles.

**Halts.**—About one-half hour after starting, the column is halted to allow a brief inspection of the mechanism, and for same purposes as a column of troops is likewise halted. Thereafter, a halt of ten minutes every two hours to rest the drivers and allow a brief inspection of the trucks. Ordinarily however, it will be found that those two-hourly halts are unnecessary, as there will be several halts between those hours due to mechanical or other trouble.

Whenever the train halts, rigidly enforce the rule to stop motors. In case of a check on the road, each assistant chauffeur will immediately dismount and take station to observe Company Commander (or truckmaster) who will at once investigate cause of delay and indicate by signal as to whether motors will be stopped.



It is usual to make a mid-day halt of from thirty minutes to one hour duration, to permit a lunch to be eaten, to rest the drivers, and to make a more extended inspection of truck mechanism. For this noon meal, it will be found advantageous to carry a fireless cooker to allow a hot stew to be served as well as a cup of coffee. These cookers may be readily improvised by placing a couple of large milk cans in boxes, properly insulated by the use of hay, straw, or similar material.

Do not make the noon halt too long, as it is better to get into camp early than to use up time on the road and thus get into camp after dark. It will also be found that if the halt is long the men are apt to take naps, and thus will be half asleep and careless during the afternoon drive. Give them some hot food and a big cup of hot coffee, and they will drive as well in the afternoon as in the forenoon.

**Daily Marches.**—The normal daily march for a motor truck company is sixty miles. This may be increased when the roads are excellent, or if conditions are very favorable. It likewise may be decreased if conditions are the opposite.

Do not run after dark if not absolutely necessary—running at night is difficult, fatiguing and very conducive to accident.

**Daily Inspection and Upkeep.**—On arrival at camp or bivouac, drivers will make a thorough inspection of their trucks, under supervision of assistant truckmasters, and all possible repairs will be made. In case of impossibility of repairing a truck, the Company Commander decides as to the disposition of the truck and its cargo. If the train arrives late at night in the darkness, it is advisable, conditions so permitting, to make this inspection and repair on the following morning before leaving camp.

**Replenishment of Gasoline, Oil, Grease, etc.**—As soon as trucks get into camp or bivouac, they should be replenished with the above supplies. By reason of the danger of fire, the gasoline tanks should be filled during day light. If this is impracticable, due to the lateness of the hour, the Company Commander decides, according to the special circumstances, whether to put this off until the following morning or to fill in the dark. In the latter case, great precaution should be taken.

Electric lights of the trucks or flashlights should be used. There should always be a sufficient number of fire extinguishers handy and several pails of sand or soft earth to smother any gasoline that may take fire. If lanterns are in vicinity, they should be hung high, so that they will not ignite gasoline vapors, which, being heavier than air, sink to the ground.

The rule to be enforced, unless conditions absolutely prevent, is to have all trucks filled with gasoline and oil and ready to start as soon as possible after reaching camp. Do not put off anything to the next day, if you can possibly avoid it.



## Part 5

## CAMP AND BIVOUAC

**Camp.**—The diagram hereunder indicates a good general form for a permanent motor truck camp. This diagram should be regarded as a guide, the form being varied to suit local conditions. The ground used for the park should have a resistant soil, either gravel, macadamized or paved. A distance of two truck lengths is sufficient to enable a truck to enter or leave the line, and is the minimum distance allowable for trucks to enter or leave the park.

**Bivouacs.**—During road marches, it is often preferable to bivouac on the road, to avoid taking the trucks on the soft soil of fields. In such cases, two general procedures are possible:

(a) Where roadway is sufficiently wide or has practicable sides, place the trucks perpendicular to the roadway with the radiators away from the roadway, but keeping the traction wheels on firm ground, though clearing the roadway as much as possible. If the space on either side of roadway is sufficient, the company may thus be drawn up in two lines on either side of road.

(b) Where the road is not sufficiently wide for the above, the train should be closed up in a column of trucks with a maximum of one yard distance between trucks, and placed as far to the right of the roadway as possible, leaving sufficient room on roadway to allow circulation of other vehicles.

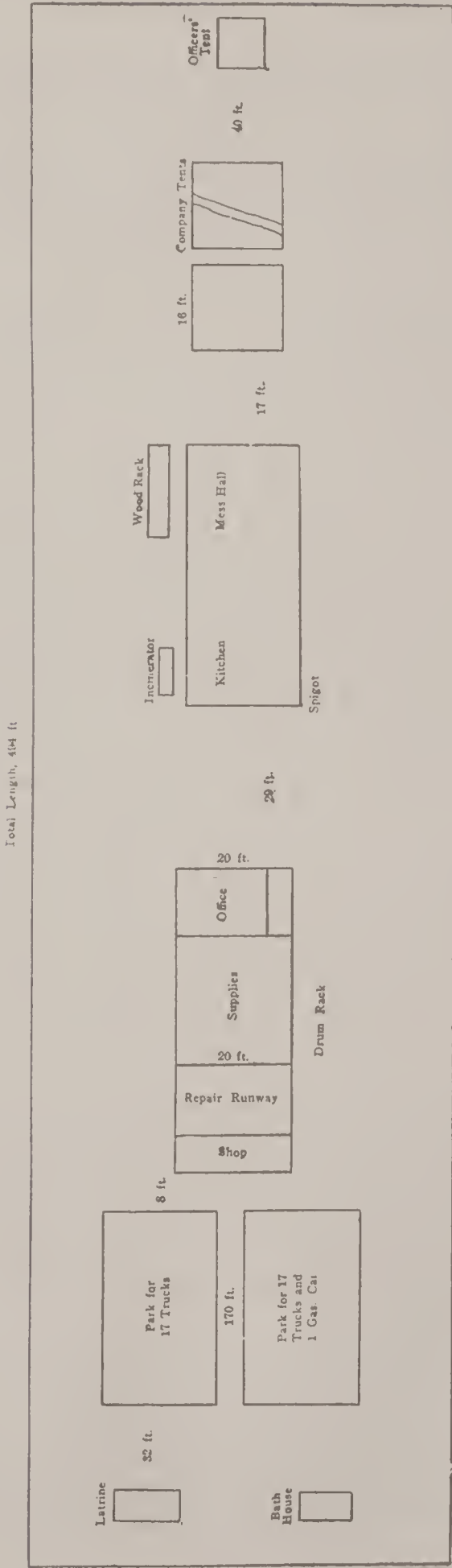
In each of the above cases, care should be taken to leave a clear passage way for passing vehicles. Precautions should also be taken to prevent accident from such vehicles. This may be done by placing lanterns or lights on end trucks, and by stationing sentinels at both ends of the line or column to warn passing vehicles and to make them take a moderate rate of speed while passing the trucks.

The normal camping rules as to sanitation should be rigidly enforced. All refuse should be burned or buried. This is especially necessary where the bivouac is made along the highway.

When in bivouac, the men will ordinarily sleep on trucks or on ground thereby,—the use of regular shelter tents being superfluous.

## ARRANGEMENT OF CAMP

Below is a standard arrangement for a motor truck company camp and written specifications for same, which were in use by a motor transportation unit on our southern border.



**Company Office Building.**—The Company Office, twelve feet in depth, will occupy the south end of the building on the main camp street. Across the south gable will be a detachable sign bearing the company designation. The interior of the office will be uniform in arrangement, having a railing separating that part occupied by the Company Commander from the rest of the office. Each office shall be provided with furniture as follows:

One table for Company Commander.

One table for clerk.

One table for field desk and one for typewriter.

A substantial record chest, with lock of the size of the regulation packing box.

A cabinet for blank forms, measuring 12x40x40 with suitable shelves and pigeon holes. (Model in supply office).

**Storeroom.**—The storeroom will occupy the remainder of enclosed portion of building as originally designed. Partition between office and storeroom to contain solid door, this door being outside of office railing. Interior arrangement of storeroom to consist of shelving and boxes as desired, approximating diagram. A door to be provided in middle of north end of storeroom, this to be divided, the lower half to be utilized as counter for issuing supplies.

A mechanic's work and tool room to be constructed across the entire north end of building, this room to have a depth of approximately  $7\frac{1}{2}$  feet, the inner partition running to the roof and being attached to the second interior rafter from the north; windows to be in each end and a single door opening inward in the center of the inner partition. Across the north end of this room will extend a workman's bench and on either side of the door against the south partition will be constructed suitable racks for tools, spare parts, etc. Between the storeroom and mechanic's room will be an open passageway which will be kept clear of all impedimenta and be utilized for placing trucks undergoing repairs. This space provides ample room for workmen, gives overhead protection and protection from the north. The engines of two trucks may be worked upon in this passageway at the same time by placing the trucks with the radiators facing each other in the center line of the building.

On the east side of building, a rack will be constructed for truck bows. Under rack will be stored tents, poles, lumber, bridge materials, etc. Oil drums will be placed on a rack on line with rear of building.

**Rules with Reference to Use of this Building.**—No cots will be put in orderly rooms and no man permitted to sleep in orderly rooms. Not more than two men shall sleep in storeroom. Mechanic's room and tool room will not be used as living room. No loitering will be permitted in any part of the building. No man shall enter the storeroom without permission. Issues will

habitually be made over the issuing counter in north end of storeroom.

**Mess Shacks.**—General arrangement as per sketch. Particulars as follows: Field range to be in northwest corner of kitchen. Base range to be built of brick and concrete, modeled after the one in 74th Company, timbers used in construction to be 4"x4" for corners and 2"x8" for siding.

**Ice Box.**—Ice box to be set in upright position from drain to outside of building and drip to be caught in keg or other receptacle; to have one shelf above for ice, open on both sides and behind to permit free circulation of air; nothing to be put in direct contact with ice; hooks to be provided for hanging meat; ice box to be cleaned daily and hot water poured through drain weekly.

**Receptacle Cans.**—Three G. I. cans to each kitchen, one for sugar, one for flour and one for general purposes.

**Cook's Table.**—Cook's table to be 3½ feet high, top to be made of 2x12's with removable 2x8 in center. Length of table 10 ft. One shelf underneath of one inch material. At the ends of table, uprights, 2x4, three feet above table surface, and on these 2x6 with nails or hooks at regular intervals for hanging kitchen utensils.—(Model in Supply Office).

**Mess tables.**—Design as at present, except that top board will be separated by a space of 1½ ins.

**Bins and Shelves.**—In northeast corner, against the wall, shelves and bins are to be built in. Three bins will be immediately against the door, arranged with the potato bin larger than the other two. Beyond these, towards the ice box, will be a platform on which is to be set all containers of food and the three galvanized iron cans containing flour, sugar, etc. Above this will be three rows of shelves with equal distance between shelves.

**Kitchen Floors.**—Kitchen floors at least three inches above dirt floor built of one inch material.

**Sinks for Dish Washing.**—Sink for dish washing as per model in 22d Company, to be in small vestibule in southeast corner of mess shack.

**Bread Box.**—Bread box as model in Supply Office.

**Incinerators.**—Incinerators to be two feet longer than the pan itself, and to have a double row of brick laid around incinerator pan reaching two and one half inches above top of pan.

**Wood Racks.**—Wood racks to be in line with incinerators. They are to be uniform modeled after rack in 74th Company and to be whitewashed. Wood to be neatly piled at all times.



**Sand Boxes.**—Sand boxes will be placed on the center line of the Company Park at extreme north end. Size of boxes 5 ft. long; 2 ft. 6 in. wide; 1 ft. 6 in. high on south side; and 2 ft. 3 in. high on north side; boxes to be painted olive drab, the north and south sides to bear company designation in block letters 10 in. high, black part  $1\frac{1}{4}$  in. thick.—(C. of M. for M.T.G., No. 1, Nov. 8, 1917).

**The Field Range.**—The following directions for the care of the field range were recently published by the Bakery Branch, Office of the Quartermaster General:

The field range can be made to do the work of an ordinary hotel range. All it needs is proper care and attention. See that it gets this.

Don't build the fire too large. You may generate more smoke than the pipe can carry away.

Cut the food small or slice it thin. The field range is intended to cook things quickly. Cut your roasts into small pieces. These cooked in a good hot oven will retain their juices and can be cooked in much less time.

Use the boilers issued for the range. Don't use big boilers of from 20 to 25 gallons capacity. It requires more than three hours to bring the contents of these to boil. The weight is too much for the field range. The period of intense heat causes the boiling plate to sag and burn out.

The issue boilers and bake pans give a total capacity of 49 gallons of food which can be prepared at one time. With equipment A and two field ranges a meal for 250 men can be prepared in an hour.

Set up the field range properly. Set the alamo on the right side of the range and see that it is set close enough so that no air can get in under the range except through the fire box. Place enough earth about one inch in height around the range so that this earth is higher than the width of the boiler away from the range. Thus if a boiler is set along the boiling plate it will lean toward the boiling plate. Articles of food may be set against the boiler plate and kept at a simmering point.

To set up the range in a permanent camp, employ one of these three methods:

Make a wooden frame six by six feet and 18 inches high. Fill it with earth, hay and old grass, with a little water. Leave a place for the fire box, ten inches deep at the opening, but tapering to four inches under the bake oven. Use flat rocks or brick about the fire box to keep the range level. Use a mixture of clay on the outside to about the height of the flange or straps.

A second method is to follow this plan, using bricks instead of the wooden box.

A third method is to build a brick wall, seven bricks high and

four bricks wide on the side the boiling plate is to come. This again gives a place for keeping the food warm.

For a temporary camp, dig the trench for the fire box three feet and about 14 inches wide, tapering from the fire box to the hole in the boiling plate and from the oven to the hole in the boiling plate. About six inches away from the deepest part of the fire trench, dig a hole about 18 inches deep. With a rod or stick, punch a small passage at an incline from this hole into the fore trench. This can be used for disposing of the slop water, which will pass into the fire trench in such quantities as to be promptly evaporated.

In using wood under the boiler plate insert it only about a foot at a time. Push it in further as it is consumed. If wood is used in too large quantities the fire will be too great and food will burn.

Give the range a fair chance. It will do the work well.

**The Kitchen Range.**—The following regulations relative to the care of Army kitchen ranges are in force in one of our National Army cantonments.

1. The ash pit will be kept clean at all times. If ashes are allowed to accumulate to such an extent that they pile up and reach or nearly reach the grate, the same is apt to melt and burn out. In emptying fires, care will be taken that the grate is not forced back into place. If clinkers are stuck in the grate they should be removed before attempting to turn the grate back to its proper position.

2. Fires should be so built that they will not reach up to or above the fire walls of the fire box. Best results are obtained by having the upper surface of the fire a little below the top of the fire box. When the fire is first built, it will be found necessary to open the drafts and allow a free circulation of air. When the fire is burning briskly, and a hot bed of coals has resulted, the drafts should be closed to prevent the escape of heat. The ash pit door should be kept in position and the amount of heat regulated by the slide.

3. When necessary to prevent water pipes from freezing fires should be banked at night. When however, weather conditions no longer endanger the pipes, fires should not be banked but withdrawn at the end of the day's work. This will increase the life of the range and allow a fresh fire every day.

4. The soot which accumulates on top of and beneath the oven chamber should be cleaned out at least twice a week. An accumulation of soot results in a loss of heat.

5. It has been found by experience that a dry bone placed in the fire once daily tends to prevent the accumulation of clinkers.

6. Burning of bacon rind, grease and other fatty substances in the range increases the heat to an abnormal degree, resulting in the fire box being burned out. This practice will be discontinued.

7. A coal box should be kept in each kitchen in order that the coal may be dry and free from ice when put into the stove.

8. A copy of this memorandum will be posted in each kitchen.

For other data on the care of field and kitchen ranges, consult Manual for Army Cooks, 1916, which no officer in charge of a company mess should be without.

## Part 6

### ROAD WORK IN THE FRENCH SERVICE

The following are notes on road regulations for motor transportation in the French Automobile Service, by a member of that service.

We have now studied in some detail the different transportation units. As I have already told you, all our work comes at the same time. When a movement takes place, it is necessary to bring up ammunition, supplies, troops,—all at about the same time, and when every one is in a hurry. It is, therefore, necessary to have the Automobile Service very carefully supervised and the authority assigning transportation units highly centralized. The following general rules should apply:

1. Up until the time of the transportation capacity of the different units is not exceeded, all should be used. When this is passed, the general should not hesitate to call in all the specially assigned vehicles to help in the work.

2. Always carefully map out the roads that are to be used by the different transportation units, so as to prevent confusion, etc. In other words, plan the movements of your trucks in just the same way as the movement of trains on a railroad is planned. Do not overlook one line, and see that time is not lost in loading and unloading. We insist on this point, for the different General Staffs of the higher units must consider this phase and see that subordinate Headquarters do not interfere. Very often, after the original orders have been given, and on the ground of "*extreme urgence*," a Section is taken off its route and sent elsewhere, and thus in its endeavor either to get to the new destination or to rejoin its old, finds itself mixed in and interfering with the movements of other formations. This has often occasioned the suspension of movements for a number of hours of this particular Section, due to the fact that in its endeavor to pass others in the same road, it has become stalled in the mud. This necessitates delay in waiting for a wrecking unit to pull it out, with the consequent impeding in the movement of the regular traffic on the same road. If confusion does not result, the original plan must always be followed.

It is very difficult to issue general regulations for the movement of this transport on roads, because the cases all differ.



Sometimes there are not many roads. This was the case in the Champagne battle, when we had only six perpendicular roads on which we could use trucks.

Whenever it is possible different routes should be used for going and coming, in such a manner as to permit making a sort of "belt" line. If only one road is available, and if this road is wide enough to permit movement in both directions at the same time, arrangements must be made at both ends of the tape, permitting the trucks to turn around on a loop. A truck, for obvious reasons, cannot turn around on a main road. It is a very difficult operation when one is compelled to use a single road for movements of any size, contemplating passage in both directions. Carelessness on the part of the chauffeur, with the consequent head-on collision will often result in entirely blocking traffic for movement in either direction.

The Officers of the Automobile Service, and in particular the Chief, are tried-out automobile transportation men. They know the difficulties, and again I ask that in all cases that arise you should consult with them on technical questions before you commit the transportation units to a certain piece of work.

I believe that the Automobile Service is an excellent tool, well and efficiently operated, and ready to give you, at any time, the best of its work.

## Part 7

### ROUTINE OF A MOTOR UNIT CAMP

As soon as a Supply Train or Motor Truck Company camp is established, orders for the government of the camp, especially the routine of work, calls, and conduct of the men, should be established. The order which is printed below is taken from one of the motor transportation units in service on the Southern border, slightly modified, and will indicate the points which should be covered in such an order. Forms for fire and guard orders, which are especially important, are printed separately.

**Truck Company Camp.**—The portion of the Motor Truck Camp assigned each truck company is shown on plan in this office.

**Responsibility of the Company or Detachment Commander.** Each company and Detachment Commander will be held responsible for the discipline of his organization and for the police of that portion of camp pertaining thereto. He will see that all orders and regulations are enforced, and that members of his company properly carry out the duties assigned them.



## SERVICE AND ROLL CALLS

The Following Service and Roll Calls Will Be in Effect Until further notice:

|  | Week<br>Days | Sundays and<br>Holidays |
|--|--------------|-------------------------|
| Reveille, 1st call.....                            | 5.45 a.m.    | 6.45 a.m.               |
| March .....  | 5.55 a.m.    | 6.55 a.m.               |
| Assemble .....                                     | 6.00 a.m.    | 7.00 a.m.               |
| General police of camp immediately after reveille. |              |                         |
| Mess .....   | 6.15 a.m.    | 7.15 a.m.               |
| Fatigue .....                                      | 7.00 a.m.    | —                       |
| Sick call .....                                    | 9.30 a.m.    | 9.30 a.m.               |
| Recall from fatigue.....                           | 11.30 a.m.   | —                       |
| Guard mount, 1st call.....                         | 11.40 a.m.   | 11.40 a.m.              |
| Assembly .....                                     | 11.45 a.m.   | 11.45 a.m.              |
| Mess .....   | 12.00 noon   | 12.00 noon              |
| Fatigue .....                                      | 1.00 p.m.    | —                       |
| Recall from fatigue.....                           | 4.30 p.m.    | —                       |
| Mess .....   | 5.30 p.m.    | 5.00 p.m.               |
| Call to quarters .....                             | 9.45 p.m.    | 9.45 p.m.               |
| Taps .....   | 10.00 p.m.   | 10.00 p.m.              |

No meal will be served after hour designated, except to men unavoidably absent on duty. The serving of meals before the regular hour therefore to men whose duties so require, will be regulated by each Company Commander.

Lights in tents will be extinguished and loud talking will cease at 9.00 p.m. Lights in officers and mess halls will be extinguished at 11.00 p.m.

**Morning Reports** will be submitted to this office before 8.00 a.m. Officers will report at the Adjutant's Office between 11.30 and 11.45 a.m. for orders and instructions.

The Sick of motor truck companies will be sent at hours designated to the Infirmary for examination by the Surgeon. Names will be entered on sick report book of the organization and this book, after signature by the Organization Commander, will be sent by a noncommissioned officer to the Surgeon.

**All Orders, Reports, or other Communications** intended for higher authority, will be sent through this office.

**Roll Calls.**—There will be a roll call at reveille and one at tattoo (9.00 p.m.) at which all men will be in ranks, excepting cooks, men absent, sick, men in confinement or in the hospital, one man in charge of quarters and men on pass. Report of tattoo roll call will be made immediately thereafter to the officer of the day in front of the guard house. A check roll call will be made by the non-commissioned officer in charge of quarters at 10:00 p.m.

daily, the result of which will be made to the officer of the day in front of the Guard House.

**Uniform.**—No variation from the prescribed uniform will be permitted. Proper and neat dress will be insisted upon at all times. All men going on pass will be inspected by the non-commissioned officer in charge of quarters of their respective companies before their departure from camps, particular attention being given to the wearing of proper insignia.

Truck drivers will wear the service uniform with shirt. When conditions warrant, Company Commanders may permit blue denim to be worn, provided the same is clean and presentable. No combination of olive drab and blue denim will be tolerated.

The order should prescribe also regulations regarding passes and leaves of absence and might well include such matters as care of grounds and arrangement of equipment. In each company there should be posted especially a list of the duties of the non-commissioned officer in charge of quarters, and room orderly, who should be detailed from the company by roster; regulations should be posted in the mess room or kitchen defining clearly the duties of the mess sergeant, cooks, kitchen police, and dining room orderly and prescribing conduct for the mess room at meal times. Orders should be posted from time to time to meet special conditions, so that the men may have no chance in case of an infraction of rules to claim ignorance of the same.

A good sized bulletin board should be put in each company, for the posting of all orders and notices affecting the men. When orders are out of date, be sure that they are pulled down, and whether out of date or not, all except such as fire and guard orders, should be pulled down after a week or so when the men have had ample opportunity to become familiar with their provisions.

## FORM FOR FIRE ORDERS

The following regulations for the government of this command in case of fire are published and will be duly observed by all concerned:

### Fire Orders

1. In case of fire the alarm will be given by the sounding of auto horns in each company, men being at once designated for this purpose in each company, by an officer or truckmaster on the ground at the time.

2. The company on guard at the time is designated as Pyrene Extinguisher Company. The men actually on post will be used to alarm the camp by the sounding of horns. The other members of the guard and all members of the guard company will at once secure extinguishers and fall in in the company park

unless directed to the point of fire. Each company will keep its extra extinguishers at a designated and well known place, ready for instant use in case of alarm. In the absence of the Commanding Officer, the guard will be under the orders of Fire Marshal.

3. Motor Truck Companies No. 68 and No. 21 are designated as Special Guard Companies. In case of alarm, these companies, or the one not on guard at the time, will fall in in their company streets and throw a guard around the entire camp. This guard will prevent the entrance of unauthorized parties into camp, prevent theft and guard against disorder generally. They will receive orders from the Commanding Officer or the Fire Marshal.

4. Motor Truck Companies 36 and 42 are designated as tool companies. In case of alarm all members of these companies, or of the one not on guard at the time, will at once secure picks, spades and axes, fall in on their company street and await the orders of the Commanding Officer or the Fire Marshal.

5. Motor Truck Companies 17 and 60 are designated as Sand and Gunny-sack companies. These companies will provide themselves with a full complement of sacks for smothering of fire and buckets filled with sand. In case of alarm they, or the one not on guard at the time, will fall in on their company parades and report to the Commanding Officer or Fire Marshal.

6. Motor Truck Companies 28 and 30 and Detachment will fall in in their company streets and be held in reserve, reporting to the Commanding Officer or Fire Marshal.

7. Each organization of the command will provide itself with two piles of sand of at least four cubic yards in the company park. The sand will be kept sufficiently moistened to avoid loss from the wind. It will also keep on hand twenty-four sacks, to be used for smothering fires.

8. In case of alarm of fire in the post all organizations will fall in and await orders.

9. Captain F. L. Case, Q.M.C. is appointed Fire Marshal. The Officer of the day on duty will act as Assistant Fire Marshal. In case of alarm, organizations will not be dismissed until reported to the Commanding Officer, Fire Marshal or Assistant Fire Marshal.

10. In the absence of the Fire Marshal, the senior officer present will perform his functions.

### Precautions Against Fire

**Gasoline Must Be Handled with Care and Common Sense.** Gasoline vaporizes easily and as the vapor is heavier than air, it sinks to the ground. When filling the gasoline tank, be sure that there are no open lights or fire near. If the tank, is to be



filled at night, do not use a flame lamp. Use an electric flash lamp. Do not use the gasoline funnel for anything else.

**In Case of Fire Do Not Try to Put it Out with Water.**—The burning gasoline will float and spread the fire. Always keep a pail or two of sand handy, and smother the flame with it. A fire extinguisher should also be kept at hand in the shop or in the truck park.

In case of a truck catching fire, the first thing to do, if possible, is to turn off the supply cock from the tank to the carburetor and then push the car away from the blazing gasoline on the ground.

Do not let a pool of gasoline drip from the carburetor when priming it as a chance short circuit may give a spark that will set it on fire.

**Keep All Engine Parts, Drip Pans and Underparts of Vehicles Clean** and the gasoline that drips onto these parts will soon evaporate, thereby greatly reducing the possibility of fire.

**A Waste Can** will be kept in shop and in park. All oily, greasy and inflammable waste or rags will be placed therein, and not left lying on benches or floor. This soiled waste can be washed in gasoline and used several times, thereby reducing expenditure, if it is carefully placed in cans until convenient to clean.

**A Sand Box** at every truck, such as is described on page 136 above, is the most efficient protection against fire which can be had.

## FORM FOR GUARD ORDERS

1.—**The Guard** will consist of two non-commissioned officers, preferably assistant truckmasters, and twelve other enlisted men of the company.

(a) The entire guard will be furnished by company detailed by roster from this office.

(b) Guard mounting will occur at 6.00 p.m. daily on company parades, will be informal and mounted by the new officer of the day.

### 2.—**Orders for the Officer of the Day**

(a) The officer of the day will satisfy himself that the requirements of the Guard Manual are strictly enforced, and that the general regulations for the Motor Truck camp are observed.

(b) During working hours, by frequent inspections, he will see that trucks at work are being properly handled. He will pay particular attention to the enforcing of traffic rules, and regulations as to speed. He will make a report of all violations of orders, giving in each case names of those responsible.



(c) He will be furnished an automobile roadster, to properly perform his duties. An enlisted man from the School for Chauffeurs and Mechanics has been detailed for duty as chauffeur of this car, and while he does not hold property on Memorandum Receipt, he nevertheless will be responsible for the care and and property pertaining thereto.

(d) No private vehicles of any description, except those authorized by this office, are permitted to enter or remain in the Motor Truck camp. Vendors, boot blacks, solicitors, newsboys, slop carriers, etc., etc., are excluded. If such persons desire permission, they will be referred to this office.

(e) Members of the guard will be armed as follows: The non-commissioned officers mentioned in paragraph (1), above to be armed with the caliber 45 pistol; the twelve other enlisted men with the 30 caliber U. S. Magazine rifle. Those armed with the pistol will carry seven rounds of ball ammunition; those armed with the rifle will carry ten rounds of guard cartridges.

(f) The officer of the day will remain in camp during the night of his tour.

(g) All written orders, memoranda, etc., etc., for the Officer of the day of the Guard will be pasted in a blank book kept for that purpose in the guard house, and transferred to successor daily.

### 3.—Commander of the Guard

(a) He will divide the night with the Sergeant of the guard so that there will always be one man on watch at the telephone. During the day he will assist the truck dispatcher with his duties. During absence of the truck dispatcher he will assume these duties.

(b) He will see that all regulations and orders, as well as requirements of Guard Manual, are strictly enforced.

(c) The orderly messenger for the truck dispatcher will be taken from the guard, using an available man who is not on post for this duty.

(d) In order to prevent unauthorized use of trucks during working hours he will specifically assign the trucks of certain companies to be observed and passed out by certain sentinels on post. As for example, the sentinel on No. 1 to observe the trucks pertaining to Companies 68 and 60, and the sentinel on No. 2 those pertaining to companies 17, 36, and 42. This will not prevent, however, observation of trucks from other and adjoining companies.

### 4.—Special Orders for Sentinels Post No. 1

(a) My post extends along east side of Motor Truck Camp from Austin road to last tent of Motor Truck Company No. 68.

(b) I will allow no trucks, automobiles, or other property

to be taken out of camp without a written order from a proper Company Commander, except in the presence of a proper truckmaster or assistant truckmaster of a company.

(c) I will keep a sharp lookout for fire.

(d) I will allow no private vehicles in camp without authority from the Commanding Officer.

(e) I will arrest all suspicious characters in the vicinity of camp, turning them over to the commander of the guard.

### Post No. 2

(a) My post extends along the Austin road on the north side of Motor Truck Camp from Northeast corner to Northwest corner of same.

(b) I will allow no trucks, automobiles, or other property to be taken out of camp without a written order from a proper company commander, except in the presence of a proper truckmaster or assistant truckmaster of a company.

(c) I will keep a sharp lookout for fire.

(d) I will allow no private vehicles in camp without written authority from the Commanding Officer.

(e) I will arrest all suspicious characters in the vicinity of camp, turning them over to the commander of the guard.

### Post No. 3

(a) My post extends on New Braunfels Avenue along the west side of camp from Austin Road to Southwest corner of camp.

(b) I will allow no trucks, automobiles, or other property to be taken out of camp without a written order from a proper company commander, except in the presence of a proper truckmaster or assistant truckmaster of a company.

(c) I will keep a sharp lookout for fire.

(d) I will allow no private vehicles in camp without written authority from the Commanding Officer.

(e) I will arrest all suspicious characters in the vicinity of camp, turning them over to the commander of the guard.

### Post No. 4

(a) My post extends east and west along south side of camp from Southwest corner to Southeast corner of same.

(b) I will allow no trucks, automobiles, or other property to be taken out of camp without a written order from a proper company commander, except in the presence of a proper truckmaster or assistant truckmaster of a company.

(c) I will keep a sharp lookout for fire.

(d) I will allow no private vehicles in camp without written authority from the Commanding Officer.

(e) I will arrest all suspicious characters in the vicinity of camp, turning them over to the commander of the guard.

5. All orders or instructions in conflict herewith are rescinded.

## Part 8

### SANITATION

Rigid rules for Sanitation must be put into effect as soon as a camp is established. The series of regulations printed below were in force in a truck company camp on the southern border, housed in tents.

**General Provisions.**—Men are not permitted to wash from running hydrant water, but must provide themselves with wash basins and buckets for this purpose and all washing will be confined to wash racks in front of tents. All clothing must be washed at the clothing wash racks provided for this purpose. No washing of mess kits under running hydrant water will be allowed. Ground around the incinerator must be kept free from scraps of food. All tin cans as soon as emptied will be put in incinerator and thoroughly burned out. Incinerators must be cleaned out each morning and tins cans are to be placed in garbage cans provided for this purpose. These will be hauled daily to the dump for final disposition.

**Company Kitchens.**—Kitchens will be scrubbed out once a day, care being taken to prevent too much water being used so that puddles do not collect in front of doors. All kitchen supplies will be kept neatly piled on racks provided. No boxes, sacks or kegs will be placed on the floor. All kitchen utensils will be hung in their proper places or stored on shelf underneath cook's table.

**Ice Boxes.**—Ice boxes must be arranged with two doors opening on side. They must contain a shelf above with space on both sides and in rear for the storing of all ice. Below the shelf, hooks must be arranged for the hanging of all meat.

No meat or other articles of food will be placed in contact with the ice. Ice boxes will be thoroughly washed out once a day and boiling water will be poured through the drain at least once every week.

**Dish Cloths.**—Dish cloths will be boiled out daily on the kitchen range. They are to be hung on rope provided for the purpose for drying on the inside of the kitchen. They must not be promiscuously spread out to dry on the woodrack.

**Mess Tables.**—Mess tables will be thoroughly scrubbed with soap and water daily, care being taken to remove all

grease and dirt accumulating in the cracks of the table. All receptacles for catsup, vinegar, etc., must be thoroughly cleaned at this time.

**Bread Boxes.**—A standard bread box is provided for each company. Before the new supply of bread is put into box, the old bread will be taken out and the box thoroughly cleaned, and the old crumbs swept out. All bread scraps will be placed in the portion of the box provided for that purpose and will not be kept in any other place.

**Water Kegs.**—Water kegs must have spigots from which all water for drinking purposes must be drawn. The tops will be hinged and fastened with a lock. Under no circumstances will a man be allowed to dip into the top of the keg to obtain a supply of drinking water. Water kegs will be kept in vestibule and the spigot will not be placed outside of mess shack.

**Wood Racks.**—Firewood must be kept neatly piled on racks designated therefor. All boxes and boards used for kindling must be promptly broken up and piled on rack.

**Garbage Cans.**—Garbage cans will be kept in special containers established for this purpose. These will be whitewashed at intervals and otherwise kept in state of perfect police. Only such garbage as will be consumed by hogs will be put in garbage cans. Other kitchen waste such as coffee grounds, paper, etc., must be incinerated. No slop water will be put in garbage as this must be incinerated. The garbage is collected under contract by a company designated from headquarters and no other disposition will be made.

**Urine Tubs.**—A tub for the collection of night urine will be placed in each company street at 6.00 p.m. The ground on which this tub is placed will be marked with lime and the site designated by lantern at night. This tub will be removed at reveille and emptied into the urine trough in the latrine. Latrine boxes will not be moved and no urine poured through seat holes in box. The tubs are all burned out and prepared for use the next night by the attendant at the latrines.

**Latrines.**—Care will be taken to prevent waste paper from being scattered therein. Toilet paper will be provided by each company. All care of latrines is left to attendant appointed.

**Ventilation.**—The extreme importance of proper ventilation is urged upon all men. Close contact in improperly ventilated tents predisposes to pneumonia, tuberculosis and other contagious diseases. Only by proper ventilation at all times can the health of the individual be preserved. An opening at the top as well as the door of the tent is absolutely necessary to keep the air inside the tent moving.

**Venereal Prophylaxis.**—A tent for the administration of prophylaxis is established near Infirmary, and is open at all hours



of day and night. Prophylaxis must be taken within eight hours in order to insure prevention of venereal disease. Rules are posted for the administration of prophylaxis within the tent. After each administration the individual must make out a slip which will be obtained from attendant in Infirmary tent. This must be rigidly carried out.

**Animals.**—No cats, dogs or other animals are allowed within the camp. To harbor these is to spread disease and to contaminate the kitchens, tents and grounds around with the feces from these animals. Each company is held responsible for all animals appearing therein.

**Waste Water.**—All slop water will be put into incinerator pan and incinerated. This includes all water that is used in the kitchen for whatever purposes. Clear water from ice drip may be thrown onto the ground where exposed to the sun.

**Incinerators.**—The incinerator pan must be allowed to boil down once daily, and the sediment in the bottom of the pan must be shoveled out and thrown onto the fire or put in the ash can. Before the fire is started in the morning, the ashes of the incinerator, along with burned out cans, must be removed and deposited in the ash can provided for this purpose. This is absolutely necessary in order to maintain a proper fire during the day in order to incinerate the water that accumulates.

For units housed in wooden cantonments, regulations should be issued to meet the different conditions obtaining there. The kitchen especially should be kept spotlessly clean, every other board in tables loose so that waste which gets down through the cracks can be washed off, good ventilation provided for the store-room, a rack provided for mops and brooms, all bins built six inches above the floor so that the floor can be scrubbed out underneath—these are the important things that should be looked after. The latrines should be kept well aired, the stools, closets and urinals given frequent cleanings (Chloride of lime should be used as a disinfectant); floors and benches thoroughly policed and washed. The barracks should be well ventilated; a wide open period for all windows prescribed for certain hours of the day, and some ventilation provided for the entire day. Bunks should be at least  $2\frac{1}{2}$  feet apart. The floors should be thoroughly swept out each morning and afternoon, and scrubbed out once a week.

## Part 9

### RULES TO GOVERN CHAUFFEURS

#### Instruction in Driving

(a) Before starting on a trip, see that gasoline tank, oil reservoir, radiator, grease and oil cups are filled.

Inspect your car for leaks in the hose connections, radiators or around the pump cooling system.

See that oil pump is in proper working order and all oil connections tight.

(b) Before cranking motor, see that speed change lever is in neutral position and emergency brake lever set. Turn on switch and retard spark or, when starting on magneto, as is done on most vehicles now, advance spark. Move throttle control lever up a few notches, just so engine will not race and spin crank with the thumb around extended along the crank handle. Do not grasp handle with the thumb around it for should the engine kick back, the crank would jerk the arm downward and the result would be a strained or broken arm. Return crank to crank holder.

(c) After engine is running return to seat, then switch to magneto side if starting on battery ignition. If starting on magneto, there is nothing further to do before throwing out clutch. Advance spark and retard throttle to idling position.

Next throw out clutch by pressing clutch pedal and move gear shift lever to first speed position. Release emergency brake and engage clutch gradually which will allow the load to be picked up slowly and without jerking or injuring the car. Before changing to second speed, accelerate motor slightly, by pressing down accelerator, throw out clutch and move speed lever to second speed position. On going to a higher gear the speed of engine should be accelerated in relation to the speed ratio of the higher gear.

(d) Should the gears clash do not attempt to force them in mesh. Let clutch in and then disengage it and shift gears quickly. This turns the clutch shaft and moves gears so the teeth will come in mesh. In changing to a lower gear, slow car down to the lower gear ratio. Do not try to shift to a lower gear, (which is going at a speed of ten miles an hour) from high gear when you are going twenty-five. You may strip the gears.

(e) Most of the damage done to cars by drivers, can be laid to two causes, ignorance and carelessness, and neither will serve as an excuse.

When filling gasoline tank, extinguish all lights having an open flame and do not have the engine running. It is best to strain gasoline through a piece of fine cheese-cloth instead of chamois, for this reason. At times the air is so heavily charged with electricity that the static current is induced in everything around the car. It needs but a slight friction to produce a spark and a fire is the result.

(f) Never allow your engine to race when changing gears. It is a useless and harmful practice which marks the ignorant driver. It does not get you anywhere and will soon cause serious damage to the whole car from vibration.

In going up grades should your motor labor, change to a lower gear at once. No good can be gained from whipping a tired horse; he will only fall the sooner, and the same rule applies here.

(g) Do not try to show someone what your car can do by rushing grades or bad places in the road on high gear. This places a severe strain on the whole car. If the other fellow happens to be a *good* driver he will not be impressed with your driving. Better show how *far* it will run than how *fast*.

Always change to the gear needed to take you up a steep grade, *before* attempting it. Gear changing in the center of a steep grade, places an added strain on all parts of the car as it has to pick up the load from almost a standstill every time the gears are shifted.

(h) In driving over muddy or sandy roads, endeavor to keep the wheels on one side of solid ground, if possible. Apply brakes gradually at all times. Locking the rear wheels by sudden application of brakes, tears the tires, places a severe strain on the differential and springs. The man who is careful on this point is very seldom seen making a figure eight on the streets when the streets are slippery.

Never bring the car to a stop in deep sand, mud or snow if it can be avoided. It may be easy to stop, but remember you have to start again.

(i) In descending a steep grade, when you have a heavy load, do not depend upon your brakes alone. Change to a lower gear and allow your engine to act as a brake, or air compressor. The car cannot go faster than the low gear will allow it. The brakes can be used to further retard the speed if necessary.

Should you be driving individually, that is, not with a train, it is good practice to cut off ignition and retard throttle lever, using only the compression in cylinders as the motor will only be drawing air through it. The motor will be cooled.

(j) Inspect your gasoline, water and lubricating systems frequently, when driving over rough roads. Investigate all unusual noises about your car immediately; you can never tell what it may be, or what serious damage may be done if the trouble is not remedied at once.

Do not, under any condition, race the motor by coasting fast with gears in mesh. Throw out clutch and allow car to coast, but do not allow it to run beyond the prescribed governor limits. Care should be taken to see that car comes to a full stop before changing to reverse. The gears cannot turn in two directions at the same time, something *must* give way.

(k) Do not become a Magneto or Carburetor fiend. There are a number of other parts of a motor or its different systems that are more liable to be at fault; look them over first.

Day-dreaming is a dangerous practice. Keep your eyes to the front. Be wide awake at all times. It is up to the man behind you to watch your rear and you can save your car by watching your front.



Watch your brakes and keep them adjusted, and all moving parts lubricated. Some day you may need them in a hurry and if you take the proper care of them, they will respond to the treatment and "be there" when you need them.

(l) Do not drive with a slipping clutch. It causes the motor to race and heat, the clutch plates (or facing) to burn, and impairs the general efficiency of the motor. Make sure that your car is equipped at all times with a fire extinguisher, fully charged and carried in a convenient place.

(m) If your car loses traction, do not race your engine and cause the wheels to spin until they are buried in the sand or mud. Instead, put straw, burlap, brush, or any material beneath your wheels upon which they may gain traction. If they sink too deeply to make it possible, jack them up until they are on a level with the road bed and fill in under them with flat stones.

(n) If you come to a stream, first find the depth of the water, and if it is such that it will cover the carburetor or the magneto, do not attempt to cross. In crossing streams where the water will not quite reach the magneto, it is well to cover the magneto to prevent it from becoming splashed with water.

In case truck is not provided with chains, rope wrapped around the wheels will make a good substitute.

Although you may be an experienced driver and have confidence that you can handle your car under any circumstances, always make allowance for what the other person may do, who may not be so well qualified as yourself.

(o) **Stop When There is an Accident**, whether it is your fault or not. Render all assistance possible, and as a safeguard, get the names and addresses of witnesses.

(p) **Excessive Sounding of the Horn is Proof that the Motorist is a Novice.**—Sometimes, as in the presence of a frightened horse, it may be better not to use the horn at all. No accepted rules exist in regard to the meaning of horn blasts, but it is reasonable to assume that prolonged honking indicates that the car behind is going to pass and desires a clear road. Do not sound horn except when absolutely necessary. Careful driving is far superior to horn blasts.

(q) **Use of Head-Lights.**—Do not use the electric headlights turned to the "bright" position when approaching or passing a car or other vehicle, on a narrow road, unless you are traveling in the same direction. The light confuses them and may result in a serious accident. Headlights should be properly adjusted to comply with laws. In many states, glaring headlights are absolutely prohibited.

(r) **See Charts for Turning Corners, Passing and Other Traffic Regulations**, and be sure you observe the laws. Figured in dollars and cents it is cheaper for a motorist to be



stopped by a highwayman than by an officer of the law. Orders in force hold the driver responsible for accident, unless he can show that it was not his fault and that he could not possibly have avoided it.

(s) **Do Not Hog the Middle of the Street.**—Give the other fellow room to go by and when he attempts to pass you do not speed up, and perhaps crowd him into the safety zone. Rigid rule for trucks and truck trains is to stay well on RIGHT of ROAD.

(t) **Never Use a Cutout.**—They are of no use, except possibly in high powered racing cars on track.

(u) Keep constantly in mind the fact that a report is kept in each train of the expenditures on each car and that your rapid promotion depends upon your efficiency. A driver whose car shows a large expenditure every month not only destroys his opportunity for promotion, but also places himself in a position for reduction.

(v) Never smoke while operating a motor vehicle, as a driver's hand should always be in a position to meet any emergency, and a sudden gust of wind will cause your vision to be obscured by ashes or smoke blowing in your eyes.

(w) Sound your horn or other signaling device when rounding a corner, going around a standing vehicle or passing a moving vehicle, as little precautions often prevent serious damage to your car and injury to yourself.

(x) Never loaf when starting on a trip as this necessitates either speeding to make up lost time, or arriving at your destination late, and either offense marks your inefficiency and often prohibits you from holding a position of trust.

(y) You would not entrust your life to a man that smoked in a room filled with high explosives. Neither do your superior officers care to trust a man who uses intoxicating liquors with a motor car, as he not only endangers the safety of his car and his own life, but also the lives of his passengers and pedestrians.

(z) It is better to slow down and allow another moving vehicle to pass in front of you than to risk damage to your car and self.

(aa) Obtain manufacturer's book of instructions for the car which you are driving and follow out the instructions, as the manufacturer knows the requirement of the car better than you.

(bb) A driver shows his inability and lack of experience by starting with sudden jerk and stopping within 10 feet by sliding his wheels; also by sounding his horn when unnecessary.

(cc) In train driving, provide yourself with a pair of goggles as they protect your eyes and avoid accident by preventing your eyes becoming irritated and being unable to see clearly.

(dd) Under no consideration allow your fellow driver to persuade you to ignore these rules and advice, as it is without a doubt the reason he holds no higher position than he does.

(ee) Learn to shift your gears without looking down at your shifting device as your eyes ought to be on the road.

### Don'ts to Prevent Trouble

Don't forget that your position and pay depends upon satisfactory service.

Don't forget your lubricating and cooling systems.

Don't forget that a squeak from your car means oil needed.

Don't forget to test your batteries every week with a hydrometer, and in that way make sure that your battery is properly charged; also examine the plates to see if they are covered with distilled water.

Don't forget to drain your radiator in cold weather.

Don't try to start until sure that spark lever is retarded.

Don't start to crank engine until sure that speed lever is in neutral position.

Don't run in the batteries (the batteries are made for starting) use the magneto.

Don't run without oil.

Don't mix different grades of oil.

Don't put lubricating oil on a leather faced clutch.

Don't run with the spark too far advanced.

Don't coast down hill at high speed.

Don't overload.

Don't overspeed. "Slow but Sure" is the motto.

Don't waste time when loading and unloading and then race the truck on the road to make it up.

Don't try to speed through bad roads; it will be time lost in the end.

Don't race with another car, the truck is built for carrying, not speeding.

Don't turn corners at high speed.

Don't let the motor race when the truck is standing; a few minutes will do more damage than many miles of hard driving.

Don't leave truck with engine running.

Don't let the clutch in suddenly; always engage it easily.

Don't start or stop with a jerk.

Don't drive your car with the brakes on.

Don't put a new chain on a badly worn sprocket.

Don't forget that the pan, engine and other mechanical parts of the truck should be kept clean.

Don't leave your extra tires exposed to the weather.

Don't see how close you can come to the other fellow's vehicle; keep a safe distance.

Don't drive fast past school houses or other places where children are liable to dart out in front of you.

Don't forget your steering gear, and the condition of your brakes.

Don't forget to inspect your truck twice daily (Noon and Night).

Don't forget that you do not own the highways; others may care to use them.

Don't forget the "Man at the wheel" is responsible for anything that happens.

Don't forget to use your brakes sparingly, and to adjust them when loose.

Don't take chances; remember you are entrusted with property valued in thousands of dollars.

Don't forget the Rules of the Road, also Traffic regulations. Ignorance of the law excuses no one.

Don't stop the truck in the mud, deep sand or wet clay; you need traction to start again.

Don't under any conditions, let the engine labor.

Don't attempt to put gears in reverse until truck is brought to a complete stop.

Don't examine carburator or gasoline tank, or engine, with an open light; use a flashlight.

Don't smoke while filling or examining gasoline tank.

Don't think you know it all; others know something too; hence we all can teach and learn something of mutual value.

Don't forget that the orders from a superior must be obeyed.

Don't neglect the noises which indicate coming trouble, and above all don't forget that there is always another man more capable than yourself ready to take your job if you don't do it satisfactorily.

## CARE AND UPKEEP

1—Keep all parts of vehicle clean. Grease and oil collects dust and grit which cuts bearing and all movable parts. Mere external washing or hosing will not do. Dirt must be scraped off if necessary. This thorough washing and cleaning denotes the interest and pride the driver takes in the upkeep and appearance of his car.

2—Always keep side and tail oil lamps filled, and wicks trimmed.

3—Eliminating all squeaky and rattling noises, as a little oil or tightening of a bolt or nut not only will save the wear and breakage of same (which means eventually work on the drivers part of replacing parts), but also removes a source of annoyance.

4—Examine tires daily. If there is a cut or separation of the rubber, cut it off and round the place of break, so that the tire will not strip off. A square or abrupt edge left in a cut or break will quickly cause a long piece of rubber to strip from the tire, thereby greatly shortening its serviceability.

5—Whenever you have your truck out on duty and are

waiting for orders, or to load and unload, employ your spare time in looking after the adjustments to your car. Utilize the first halt to turn down all grease cups,—other halts to tighten certain bolts, put in screws, or do the many minor adjustments to keep your car and its equipment in absolutely A-No. 1 shape. Then when you return to the park in the evening, your truck will be all fixed up and you will not have to do hurried or night work to get it in shape. Keep your truck in perfect condition at all times.

Many of our States, Territories, and municipalities provide for registration of motor vehicles operated within their limits, and impose a special tax upon such vehicles through fees for permits, or licenses, or for identification tags. By decision of the United States Supreme Court it is held to be well-established law that the property of the United States and the instrumentalities whereby it performs its proper governmental functions can not be taxed. All officers of the Army are therefore instructed as follows upon this subject.

(a) It is not necessary to procure such license to cover the use of a motor vehicle owned by the Government, or operated exclusively by officers or employees of the Government, for official purposes only. The use of public funds for the procurement of any license for a motor vehicle, or for the purchase of identification tags supplied by civil authorities, is hereby prohibited. If, for their own convenience local officials are willing to grant a license and furnish suitable State identification tags or plates, without charge, in no way involving an expenditure, the same will be accepted and placed in use with the vehicle for which issued, along with the plates furnished by the Government.

(b) All motor vehicles owned by the Government and operated exclusively by officers or employees of the Government, for official use in the military service, will have attached to them metal plates bearing an inscription reading as follows :

For the Quartermaster Corps :

“Q. M. C., U. S. A.,  
No. —.”

For the Ordnance Department :

“O. D., U. S. A.,  
No. —.”

For the Medical Department :

“M. D., U. S. A.,  
No. —.”

For the Corps of Engineers :

“C. of E., U. S. A.,  
No. —.”

For the Signal Corps :

“S. C., U. S. A.,  
No. —.”



The plates, which will be provided and numbered by the department purchasing the vehicle, will be about 7 inches high and 12 inches wide, and will conform in a general way to the requirements, in this regard, of the localities in which said vehicles are to be used. The proper officer will give notice, in advance when practicable, to the local authorities charged with the duty of registering motor vehicles of the general public, stating that Government vehicles are in use in that locality and the marks and designation they bear. In such notification reference should be made to the decision set forth in first part of paragraph 1 above.

(c) Great care will be taken to observe regulations as to speed and as to rules of the road, and all concerned will acquaint themselves with these regulations.

(d) If, while in use on official business, a motor vehicle be stopped by a police officer, or if otherwise there be interference by State or other local authorities because of failure to make registration and pay such special tax, the officer or employee should give full information as to the ownership and use of the vehicle, and the instructions under which operated, and should courteously request that there be no further interference. In case measures are then resorted to by State or local authorities to obstruct or prevent the proper use of such agencies or instrumentalities of the United States, full report will at once be made to The Adjutant General of the Army, with the view of submitting the matter to the Department of Justice for such legal action as it may deem necessary to protect and make clear the rights of the United States in that regard.

(e) The foregoing instructions do not apply to automobiles owned by officers and others in the military service which are used for private purposes. Such vehicles come strictly within the laws and regulations as established by State or other local authorities, and the use thereon of tags marked "U. S. A." or "U. S. Army" is prohibited.

## Part 10

### REGULATIONS FOR HAULING WORK

The nature of the transportation duties of a truck company may be roughly classed into depot work and route work. In depot work, the truck company does not operate as a unit, but the trucks work singly or by detachments, and are normally on runs permitting all trucks to park nightly in the company camps.

**Route Work.**—In this service, the company operates as a unit, a specified cargo being turned over to the Company Commander for transportation to definite destinations. After loading, way bills or shipping invoices are turned over in regular forms to the Company Commander, who signs for all articles thus shipped. On arrival at destination, he delivers cargo and obtains receipts therefor to relieve him of his responsibility.

The Company Commander should keep copies of the way bills for each truck, and should make a list of his trucks giving destination of cargo on each, it being very necessary that he be able quickly to tell which truck has either a given destination, or cargo, so that he may know at all times the location of all supplies in his train. See Quartermaster Manual, par. 3918.

**Depot Work.**—In this service, trucks are ordinarily detailed to various warehouses and supply points, and are worked under various foremen, as far as the supplies transported are concerned.

It may happen that the Company Commander will be called upon to map out the transportation system and superintend its operation. The following procedure is therefore described, and while it assumes the operation of several companies, suitable changes may be made either to limit it to one company or to conform to local conditions.

When two or three trucks are dispatched on the same detail, one of the drivers will be placed in charge and held responsible for the proper execution of the duty, the maintenance of good order, etc. In larger details, an assistant truck master will be sent in charge. Whenever the major portion of a company is dispatched upon the same detail, an officer of the company should accompany the detail and personally supervise its operation. (C. of M. for M.T.G., No. 2. November 16, 1917.)

**Dispatching Trucks.**—A suitable noncommissioned officer is permanently detailed as Truck Dispatcher, an assistant being detailed when necessary. These men are continuously on duty from 6.30 A.M. to 8.30 P.M. The Dispatcher sleeps in the Dispatchers office within sound of the telephone.

Each evening, the Dispatcher makes out written orders for trucks of the various companies to fill the work details for the next day. There is certain work, involving delivery routes, that is permanently assigned certain trucks. Other regular classes of work are done by each company according to roster with a view to equalize details.

In a similar manner, each truck company takes its turn, by roster, to be on duty to answer special calls.

**Orders.**—Orders for trucks are received from the following sources :

Permanent work detail for Depot Quartermaster and other authorities.

Special daily orders from Depot Quartermaster sent out each evening in writing by Depot Quartermaster.

Other proper calls made in person or by telephone.

All orders for trucks, except the regular details of the Depot Quartermaster (which are received in typewritten form) are entered on the daily blotter. (Form 1 shown on page 76.)

Beneath are printed sample regulations for traffic and accidents, again taken from one of our motor transportation units on the southern border. These should be established in every motor transportation organization camp.

### TRAFFIC REGULATIONS

It is contemplated that Company Commanders supervise actively the operation of their trucks, and for this purpose will make daily inspections of the operations of their details at work. During this inspection, officers will observe carefully the character and amount of work being done by these details, and if convinced that the number of trucks employed on any duty is in excess of actual requirements, will make memorandum report to this office of changes recommended. No change, will however be made without reference to this office. They will also compute the approximate time which should be consumed in the execution of various assignments and will cause a check to be made with a view to prevent drivers from loitering away from the company park.

All officers and non-commissioned officers are charged with the duty of reporting violations of traffic, speeding and loading regulations, and will report all violations of the regulations coming to their notice, whether observed in their own trucks or those belonging to other organizations of the group. This report to be made in memorandum form to this office with brief statement of time, place and circumstances. Officers on duty at detached points will exercise general supervision over all detached trucks of the group operating in that locality and submit reports thereon.

The daily work of trucks will be regulated in accordance with special instructions from this office. Calls for trucks will be issued to the companies by the truck dispatcher, who, in the discharge of his duty, will be considered as acting in the name of the Commanding Officer. Unless otherwise ordered, one truck of each company will be kept in daily for general overhauling.

**The Traffic Ordinances** for the city will be carefully observed by all drivers. Drivers will allow no person to ride on their trucks unless such person has proper authority therefor and under no circumstances will persons be allowed to ride on fenders, or on running boards.

No trucks are permitted on paved roads through the Artillery and Cavalry Posts, except along New Braunfels Ave.

**Speed.**—Trucks will not exceed a **Speed of Ten (10) Miles** per hour.

**Cut Outs and Mufflers** will be kept closed at all times.

**Skid Chains** will not be used on trucks while driving on paved streets of a post proper, or in the City of San Antonio.

**Salute.**—Enlisted men while actually driving trucks or automobiles will not salute.



**Stopping Motors.**—Motors will not be permitted to run when trucks are stopped for a period of one minute or longer.

No trucks will be removed from the park except by order of the Company Commander or Truck Dispatcher.

The maximum rate of speed is as follows: Within the limits of any city, town, or village, 10 miles per hour; outside of such limits, 14 miles per hour. All civil traffic regulations will be obeyed as far as possible.

No person will be permitted to ride on a truck unless he has authority therefor, and under no circumstances will persons be permitted to ride on the fenders or the running boards.

The racing of motors to warm them up is prohibited.

As chauffeurs require both hands on the wheel at all times, except in signalling and in sounding the horn, they will not salute or smoke while actually driving.

Motors will not be permitted to idle when trucks are stopped for a period of one minute or longer.

In every case of accident the chauffeur will stop and ascertain the damage done, render any assistance necessary, and secure the names of witnesses present. He will make a full report of the accident to the Company Commander as soon as possible. Remember that it is better to give the "hog" all the road, when it can safely be done, rather than have a collision.

The truck skid chains will not be used on paved streets.

The use of a lantern or any kind of light except electric, in refilling with gasoline, oil, or like supplies, or in doing work around such articles is forbidden. The proper men are issued flashlights for this purpose.

The filling of the Pyrene fire extinguisher with gasoline, mineral oil, or like substance, and using it as a hand pump in cleaning mechanical part, or for other purposes, is prohibited.

No private motor vehicle will be permitted to park within the limits of the company, and it is prohibited to work upon a private vehicle within such limits or to take tools from the company for the purpose of working upon such vehicles.

The truck tail gate will be kept up and properly fastened, except in hauling articles longer than the truck body, in which case it will be lowered and securely tied back in order to prevent its being damaged by swinging loose.

### Accidents

In case of accident, the driver will invariably halt and render any assistance possible. He will make a report to his Company Commander of any accident immediately upon his return to his company, or, in case of serious accident, will at once report by telephone. The driver should procure the following data before leaving scene of accident:

Name and address of driver of car.

Name and address of any passengers riding in car.

License number of vehicle and extent of damage.



He should carefully note physical condition, such as bad roads, or slippery pavement; whether or not a warning signal from the other vehicle or car was heard before the occurrence of the accident, and all other circumstances which may show the cause or fix the responsibility for the accident. The driver, before leaving the scene of the accident, should draw a rough diagram showing location or positions at time of accident and a second diagram showing positions after the accident.

A driver will be held strictly accountable for any accident, unless he can clearly show that it was not his fault, and also that he could not have possibly avoided it.

Officers will make reports, in triplicate, of all accidents occurring in their companies, requiring all evidence submitted to be in affidavit form from enlisted men and civilians, and in the form of certificates from officers. Diagrams showing street and relative locations should be submitted. In case the injured party states that he does not expect to press claims, affidavits to that effect should be secured. In making this report, after giving their analysis of the evidence, officers will make a clear, definite and concise recommendation following the general form used in reports of survey.

## Part 11

### INSPECTIONS AND REPORTS OF MAJOR REPAIRS

Each Organization Commander before requesting that any motor vehicle under his charge be turned over to the Quartermaster Mechanical Repair Shop for necessary repairs, should make a personal and critical examination of the vehicle in question, determining as far as practicable exactly what repairs are needed, what caused the damages required to be repaired and whether or not the condition of the vehicle is due to carelessness or neglect on the part of the personnel of the organization. The results of this examination should be submitted to organization headquarters on a separate memorandum which will accompany the request for repairs.

Upon receipt from the shop of any repaired motor vehicle, Organization Commanders should make a careful personal examination and in case any defects or omissions are discovered, a written report in detail thereof should be made.

## Part 12

### COMPANY SCHOOLS

Company Commanders may well organize classes for the instruction of all members of the company in geography of the locality and its environs in which serving. These classes should be continued until all men are conversant with the location of outlying townships and camp-sites; the names of main roads and

streets; prominent municipal buildings and government warehouses; freight depots and loading stations, etc.

No trucks should be dispatched until the drivers definitely know the location to which going and the shortest direct route thereto. In case of doubt, a rough sketch of the route will be furnished the driver.

**Test of Candidates** for appointment as Chauffeur, or for Transfer to Supply Train.

Name: .....

Age: .....

Rank: .....

Service: .....

1. Can he write a legible hand:
  2. Can he spell ordinary words:
  3. Does he understand Long and Short Division of Arithmetic:
  4. Does he understand Multiplication:
  5. Can he read and explain meaning of any article chosen from newspaper:
- General Intelligence:

## PRACTICAL EXAMINATION

Make of Car:..... Number of Car:.....

Time in: ..... Time out: .....

Ability to start up:

Ability to drive over varied ground:

Ability to turn in limited areas:

Ability to move backward:

Ability to move forward:

Ability to shift gears:

Ability to turn corners:

Ability to start and stop:

Ability to control car:

Ability to move in traffic:

Ability to go up and down hills:

Has he self-confidence:

## PRACTICAL QUESTIONS

Motor parts:

Chassis:

Lubricating System:

Fuels and Lubricants:

Transmission:

Clutch:

Brakes:

Magneto:

Carburetor:

## PREVIOUS EXPERIENCE

Garage :

Machine Shops:

### Repair Shops:

### Driving Autos:

### Driving Trucks:

## Gas and Oil Engines:

Final Estimate:

Tester.....

Rank.....

**For Test:**

**Recommendation:**

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## Commanding.

## Commanding.

....., 1917.

## PERSONAL RECORD

1. Surname..... Christian name.....
2. Nationality..... 3. Age.....yrs.
4. Married or single..... (a) Number of Minor children.....
5. Educational Advantages .....
- (a) Names of schools or colleges attended, and how long  
    .....
- .....
6. Enlistment period in which serving.....
7. Date of present enlistment.....
8. Length of time has been a non-commissioned officer.....

## FORMER EXPERIENCE

A full statement of the experience had in:

1. Garage: .....
2. Machine Shops: .....
3. Repair Shops: .....
4. Driving Autos: .....
6. Driving Trucks: .....
6. Gas and Oil Engines: .....
7. Steam Engines: .....

## Remarks



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• • • • •

Name \_\_\_\_\_

• • • • •

.....

Rank.

## ..... Organization.





Make of Car:..... Number of Car.....  
Ability to Start up: .....  
Ability to turn in limited areas: .....  
Ability to move backward: .....  
Ability to move forward: .....  
Ability to shift gears: .....  
Ability to turn corners: .....  
Ability to start and stop: .....  
Ability to move in traffic: .....  
Ability to go up and down hills: .....  
Ability to control car: .....  
Has he self-confidence: .....

PRACTICAL QUESTIONS

Motor Parts: .....  
Chassis: .....  
Lubricating System: .....  
Fuels and Lubricants: .....  
Transmission: .....  
Clutch: .....  
Brakes: .....  
Magneto: .....  
Carburetor: .....  
Final Estimate (Excellent, Very Good, Good, Fair, Poor) :.....  
Tester.....  
Rank.....

For Test

Recommendation

.....  
.....  
.....  
.....

Commanding.

Commanding.

PRACTICAL QUESTIONS

(From question sheet No. ....)

- |      |      |
|------|------|
| (1)  | (11) |
| (2)  | (12) |
| (3)  | (13) |
| (4)  | (14) |
| (5)  | (15) |
| (6)  | (16) |
| (7)  | (17) |
| (8)  | (18) |
| (9)  | (19) |
| (10) | (20) |

.....  
Tester

## DRIVING TEST

Time out:

Make of Car:

Time in:

Number of Car:

- (1) Ability to start Engine properly:
- (2) Starting Car:
- (3) Shifting Gears:
- (4) Use of Clutch:
- (5) Use of Brakes:
- (6) Spark:
- (7) Control of Engine:
- (8) Stopping:
- (9) Reverse:
- (10) Corners:
- (11) Turning Around:
- (12) Hills. (Stop and start on hill.)
- (13) Turning around without getting off the road:
- (14) Varied Roads:

Point out parts of car as named in practical questions:

Driver Tester.

.....

## RATINGS

"Passed" indicates: Work completed without assistance in reasonable length of time.

"Very Good" indicates: Very slight assistance.

"Good" indicates: Instructor must assist.

"Poor" indicates: All around inefficiency.

## PRACTICAL QUESTIONS

1. What does advancing the spark mean, and why do we advance it? Why retard it?
2. What is the carburetor for? How is gasoline fed from supply tank to the carburetor?
3. Describe just what functions you would perform when starting the engine.
4. What is the cooling system for, and how many kinds are in use?
5. Name the various kinds of lubricating systems and describe their action.
6. How would you clean a crank case, and how often?
7. How often would you change the lubricants in the gear set, differential, universal joints, and what kind of lubricants would you use for parts mentioned?
8. Name the various kinds of gasoline supply systems and describe their action.
9. Suppose you saw your radiator steaming, what course would you pursue to stop it?

- 10. If your engine became badly overheated, what course would you pursue?
- 11. Describe how you would remove a spark plug, clean and adjust the points; What effect would too wide a gap between the points have?
  - 12. What attention should be given the storage battery?
- 13. What attention should be given the magneto?
- 14. If the water pump leaked tell how you would remedy the trouble?
- 15. What is the clutch for? How many kinds of clutches are in popular use? What attention should a cone clutch receive? a disc clutch?
- 16. What attention should be given the tires? Wheels? Steering gear?
- 17. How would you adjust the valve clearance?
- 18. Why is it necessary to throw out the clutch when shifting gears?
- 19. In passing a vehicle, going the same direction, upon what side would you pass? Describe turning a corner to the left; to the right.
- 20. After starting the engine and having entered the seat, what would you do before starting the car?

**Student's Standing for Instructor's Information**

|             |               |
|-------------|---------------|
| Name: ..... | Test No. .... |
|             | Rank: .....   |

**DRIVING TEST  
PRACTICAL QUESTIONS**

- |      |      |
|------|------|
| (1)  | (1)  |
| (2)  | (2)  |
| (3)  | (3)  |
| (4)  | (4)  |
| (5)  | (5)  |
| (6)  | (6)  |
| (7)  | (7)  |
| (8)  | (8)  |
| (9)  | (9)  |
| (10) | (10) |
| (11) | (11) |
| (12) | (12) |
| (13) | (13) |
| (14) | (14) |
|      | (15) |
|      | (16) |
|      | (17) |
|      | (18) |
|      | (19) |
|      | (20) |

"Passed" indicates: Work completed without assistance in reasonable time.

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"Poor" indicates: All around inefficiency.

.....

Q. M. Sgt., S. G., Principal Instructor.

## EMERGENCY TEST SHEET

Name: .....

Age: .....

Rank: .....

Service: . . . . .

## PREVIOUS EXPERIENCE

|                      |   |                   |
|----------------------|---|-------------------|
| Garage Driving:      | } | Machinist Helper. |
| Garage Repair Shops: |   |                   |
| Driving Trucks:      | } | Machinist.        |
| Driving Autos:       |   |                   |
| Machine Shops:       |   |                   |

## PRACTICAL QUESTIONS

(From question sheet No. ....)

- (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- (7)
- (8)
- (9)
- (10)
- (11)
- (12)
- (13)
- (14)
- (15)
- (16)
- (17)
- (18)
- (19)
- (20)

.....Tester.



DRIVING TEST

- (1) Ability to start Engine properly :
  - (2) Starting Car :
  - (3) Shifting Gears :
  - (4) Use of Clutch :
  - (5) Use of Brakes :
  - (6) Spark :
  - (7) Control of Engine :
  - (8) Stopping :
  - (9) Reverse :
  - (10) Corners :
  - (11) Turning around :
  - (12) Hills (stop and start on hills.)
  - (13) Turning around without getting off the road :
  - (14) Varied Roads :
- .....Tester.

RATINGS

- “Passed” indicates: Work completed without assistance in reasonable time.
- “Very Good” indicates: Very slight assistance.
- “Good” indicates: Instructor must assist.
- “Poor” indicates: All around inefficiency.

CLASSES

- Class (A) Passed and for assignment.
- Class (B) Partially passed. Short Instruction.
- Class (C) To receive long Instruction.

CLASS by.....  
Q. M. Sgt., S. G., Principal Instructor.

# CHAPTER VII

## MISCELLANEOUS INFORMATION

### Part 1

### TRUCK DATA

**Consumption of Oil and Gasoline.**—The consumption of gasoline and oil varies according to road conditions, experience of drivers, train discipline and other incidents of service. The following figures show the average consumption as taken from various truck company records. In figuring gasoline and oil for a trip, especially with a newly organized company, due allowance therefor should be made.

| Make of truck        | Gasoline, miles<br>per gallon | Oil, miles per<br>gallon |
|----------------------|-------------------------------|--------------------------|
| Packard 1½ ton ..... | 5.0                           | 120                      |
| Packard 3 ton .....  | 4.0                           | 80                       |
| Peerless 3 ton ..... | 3.5                           | 70                       |
| Riker 3 ton .....    | 3.6                           | 80                       |

The consumption of the lubricants, as well as the proper kind to be used, varf with type of truck and service in which engaged. The best plan is to consult the instruction book issued by the truck manufacturer which will fully cover these points.

### Dimensions and Weights of Various Trucks

|                         | Weight | Length<br>over all | Width<br>hub to<br>hub | Height<br>over<br>bows | Height<br>to top<br>of seat |
|-------------------------|--------|--------------------|------------------------|------------------------|-----------------------------|
| (a) Packard 1½ ton..... | 5800   | 18' 5"             | 6' 1"                  | 10'                    | 5' 7"                       |
| Packard 3 ton .....     | 8250   | 20' 5"             | 7' 6"                  | 10' 3"                 | 5' 6"                       |
| Locomobile 3 ton .....  | 8500   | 21' 3"             | 7' 3"                  | 10' 3"                 | 5' 10"                      |
| Peerless 3 ton .....    | 9130   | 21'                | 7' 3"                  | 10' 6"                 | 6'                          |

(b) Weight of machine Shop Truck fully equipped:

|                       |             |  |
|-----------------------|-------------|--|
| Packard 3 ton .....   | 18,200 lbs. | } Weight of shop truck-<br>equipment<br>9,100 pounds |
| Locomobile 3 ton .... | 16,700 lbs. |  |
| Peerless 4 ton .....  | 17,800 lbs. |  |
| White 3 ton .....     | 17,400 lbs. |  |

(c) Inside measurements of War Body:

|              | Length | Width | Depth |
|--------------|--------|-------|-------|
| 1½ ton ..... | 10'    | 5' 1" | 2'    |
| 3 ton .....  | 12'    | 6' 6" | 2'    |

Height inside of bows: 6 ft.

(d) Gross weight of tank truck, full.....13,760 lbs.

Gross weight of tank truck, empty..... 8,800 lbs.  
Carrying Capacity:

Number of fully armed and equipped men seated in 1½ ton truck: 24 (plus 3 on drivers seat).

Number of fully armed and equipped men seated in 3 ton truck: 35 (plus 4 on drivers seat).

Number of fully armed and equipped men seated in 1½ ton truck: 35 (plus 4 on drivers seat).

Number of fully armed and equipped men seated in 3 ton truck: 45 (plus 4 on drivers seat).

### SOLID TIRES

**Care.**—Do not carry loads beyond the prescribed carrying capacity. One overload on tire equipment is sufficient to cause a break down of the tires and result in their early failure.

Sudden starts and stops have a very serious effect on solid tires. Always let the clutch in slowly and apply brake gradually.

Running in car track causes tires to break down early. Avoid car tracks.

When it is necessary to use skid chains, apply them loosely. Never use skid chains when not actually necessary.

Tires showing unusual wear indicate improperly aligned wheels. The wheels of such tires must be properly aligned immediately.

Equalization of brakes is very important. Drivers should report a tendency of the brake to hold on one wheel and slip on the other.

**Equalizing Wear.**—When one tire on a dual equipment becomes unserviceable, while the other one is partly worn, the partly worn tire should not be discarded but matched up with a tire showing the same amount of wear and put back on the wheel for further service.

A new tire shall never be used on the same wheel with a tire partly worn. Place new tires on front when possible, providing the worn front tire can be mated with partially worn rear for dual service.

Tires should be retained in service until worn within one-half inch of rim.

**Trimming.**—Vigilance will be exercised to see that all tires are properly trimmed. Tire knives must be kept sharp. Dipping them in water occasionally will facilitate the cutting.

To trim effectively, grasp the knife firmly with one hand, while with the other, part the sliver in such a manner that the knife may reach the extremity of the cut. Then, with a sawing motion, let the knife follow through, bearing the edge outwardly so as to save all the tire possible. Round the sharp edge slightly. There should be no abrupt edges left to catch in the rocks when the tires have a chance to spin.

Tires required to be trimmed are those with small slivers developed along the edge during the day's run. These small slivers soon mature into long and heavy strips of rubber, destroying the life of the tire.

To save this premature destruction, each driver will examine all of his tires carefully after the day's trip and report to the Truckmaster when trimming is necessary. The man detailed for the purpose will then do the trimming.

Any tires which seem to be sluffing away and have the appearance of a herring bone, will be tapered only slightly. There can be more harm than good done in cutting away such tires, and special care should therefore be exercised in such cases. Tires with deep cuts will be treated in a like manner.

## Part 2

### SHIPMENT OF TRUCKS BY RAIL

Loading is done either by the personnel of the company or by details from other sources if the company personnel is not available.

**Details.**—The details should consist of four non-commissioned officers and 22 privates, as follows:

1 N.C.O. and 9 privates (4 being carpenters, and all having hammers and hatchets) to pack, load, box, and crate equipment and nail down blocking.

1 N.C.O. and 7 privates, to place skids and truck wheel blocking.

2 Privates (experienced chauffeurs) to drive cars on flat cars.

4 Privates, to guide cars, steady skids, etc.

2 N.C.O. to inspect work, check numbers, etc.

**Packing.**—In the box of each truck body pack the following articles.

(a) 1 Tarpaulin, truck cover.

1 Spade.

1 Axe and helve.

1 Pick and helve.

Padlock each end of box and tag the keys carefully with the number of the truck. Forward keys by parcel post unless personnel travels with trucks.

(b) In the body of each truck, with the exception of trucks Nos. 1, 2, 3, 4, 30, and 31, place the required number of bows and one ridge pole. The bows and ridges of the first four trucks being distributed in trucks Nos. 5 and 6, and the bows and ridges of Nos. 28, 30 and 31 being distributed in Nos. 27 and 29.

(c) All other equipment and spare parts, with the exception of seat cushions, milk cans and buckets, G.I. should be securely cased and crated. Number each case beginning with No. 1 and mark plainly with contents and weight.



(d) In truck No. 1, pack 30 milk cans upright and 30 buckets on side securely wired in two nests of 15 each. Pack lash ropes around cans and buckets and secure by running pieces of 2x4 between necks of milk cans across the truck body. Buckets and lash ropes will be slatted in.

(e) In trucks Nos. 2 and 3, pack cases and crates containing tool kits, fire extinguishers, jacks, towing cables, flashlights, pumps and hose, oilcans and tire chains. Keep load below top of side and end boards. Block and cleat with 2x4's to insure a firm load and prevent shifting.

NOTE:—Tool kits and jacks may be padlocked in tool boxes and keys tagged as indicated in (a) above paragraph.

(f) In truck No. 4, pack 30 seat cushions snugly, standing them on side edge and cleat them in by running 2x4 across the truck body.

(g) Ship trucks equipped with gasoline carrying bodies, viz., Nos. 30 and 31, with their regular quota of drums fastened in tightly by straps and turn buckles.

(h) Make a careful check of contents of each truck.

**Skids and Ramps.**—When flat cars have been spotted and standing brake rods removed, send seven men under a non-commissioned officer to place skids from car to car and from car to platform, beginning with the car farthest from loading platform. These skids are made of two inch material 5 feet long by two feet wide and well cleated. When loading from the ground, use two 16 ft. ramps of 3 inch material 2 ft. wide and brace middle of each ramp from ground. Select two careful drivers and detail one man to proceed and one man to follow each truck, to watch skids and warn drivers.

**Carload.**—Load two trucks to a car. Load three-ton trucks with radiators in middle of car to permit tail of trucks to overhang. Load one and one-half ton trucks facing forward.

Minimum length of flat car for 3-ton trucks, 41 feet.

Minimum length of flat car for 1½-ton trucks 37 feet.

The flooring of flat car must be solid and free from holes.

Reject cars with steel flooring.

**Draining.**—Gasoline tanks and radiators will be drained. Batteries of electrically equipped trucks will be disconnected. Oil need not be drawn from crank case.

**Blocking.**—Have the eight men who placed the skids, set the steel blocking snugly, one in front of each front wheel and one in front and one behind each rear wheel with flanges outside. Blocking with double flanges preferred. Ten men with hammers should follow and nail down the blocking securely, using 20d nails.

When properly placed on cars, the brakes of all trucks should be set tight.

**Invoices.**—Take name of railroad and number of car on which each two trucks are loaded, for example:

(USA—3901—46569 Serial) T & N O

(USA—3902—49830 Serial) 59951

Shipping invoices should be made from list with contents and weights of trucks and equipment.

**Inspection.**—After the trucks are thus loaded and secured, make a careful inspection to be sure that:

- (a) Blocking is fastened properly.
- (b) All brakes are set.
- (c) Tail gates secured.
- (d) Tail gate chains thrown over into bodies.
- (e) Tarpaulin boxes under bodies are padlocked.
- (f) Radiators are drained.

**Materials.**—Material required for shipping one truck company is as follows:

- 96 pcs. steel blocking, right hand.
- 96 pcs. steel blocking, left hand.
- 100 lbs. 20d nails for blocking.
- 8 pcs. 2x4-16 ft. long, for cleating.
- 200 board ft. 1x8 for casing and slatting.

NOTE:—In the event of a scarcity of lumber, a suitable crate or case can be made by using a truck body, packing same to capacity and making cleats across the body with any lumber procurable.

### Part 3

## MATTERS TO BE LOOKED AFTER IN THE MOVEMENTS OF TROOPS

(a) For the equipment of baggage and kitchen cars, see Quartermaster Corp Manual, Volume 1, paragraph 3440 and paragraph following.

(b) For allotment of space in passenger cars, etc., same reference as in paragraph (d) above.

(c) For regulation covering "Preparation of Cars," "Loading and Entraining," "Conduct of Troops," etc., see Field Service Regulations, 1914, paragraphss 389 to 402.

For use of drawing rooms, see paragraph 3470, Manual for the Quartermaster Corps.

(d) Instructions should issue that careless throwing of ashes and live coals from baggage cars endanger railway trestles, bridges, etc.

(e) Officers should be provided with several official telegraph blanks for use in emergencies,—See A.R. 814 and 1184. Reports should be made by telegraph to Commanding Officer of destination at least twenty-four hours prior to arrival at final

destination, giving organization, strength and probable hour of arrival.

(f) For equipage to be carried on change of station, see A.R. 1023. Trunk lockers not an articles of issue during present emergency.

(g) For method of addressing mail, money orders, packages and personal telegrams to individuals in Europe, see Bulletin 44, War Dept., 1917. Name, rank, and unit, followed by words "American Expeditionary Forces" is only proper mailing address.

(h) The order directing travel should be presented to the Depot Quartermaster and proper transportation request received. Ration and other accounts should be settled and ration certificate obtained from the Depot Quartermaster. Provision should be made for sufficient rations to supply organization en route and for at least four days after arrival at destination. Liquid coffee money can be obtained only under conditions stated in A.R. 1208, and when only impossible to cook coffee en route.

(i) Information should be obtained from Transportation Branch Department Quartermaster's Office as to the exact hour and point at which passenger and baggage cars will be spotted, loading details at once be made and request for freight trucks to handle company property be submitted to this office.

(j) Field return, accompanied by a complete list of personnel, also a list of vehicles giving U. S. and serial numbers should be submitted to headquarters immediately prior to departure from this group.

(k) Report will also be made to organization headquarters as to whether full clothing and equipment is taken, and, if not, reason for failure to obtain same.

(l) Before leaving camp, Organization Commanders should see that their company quarters and grounds are carefully prepared for the inspection contemplated by A.R. 1010 and 1011.

(m) Immediately upon receiving orders for foreign service an organization will report the fact to the Division Surgeon, who will inspect the command to determine whether or not it has proper medical equipment. Men permanently incapacitated for service, whether recommended for discharge or not, will be reported to him.

(n) If previous notice has not been received and entry made on service records, a certificate will be obtained from the surgeon listing by name all members of the organization in whose cases the typhoid prophylaxis has been completed. In case immunization of any member of the organization has not been completed, the statement will specify specifically the exact state of immunization of each particular man of this latter class.

(o) Whenever a command or detachment is ordered from one station, camp, or cantonment, to another or to port of embarkation for transportation overseas, careful physical examination



will be made of every man before his departure from his station for the purpose of discovering and eliminating cases of communicable disease. This examination will be made by medical officers, the men being stripped to the waist and extreme care will be taken to detect communicable diseases in their earliest stages. No man having or suspected of having a communicable disease will be sent away from his station. Scarlet fever, cerebrospinal meningitis, and measles contacts will be held in quarantine and not be permitted to leave with their commands. This examination will ordinarily be made by the medical officers of the commands from which units or detachments are ordered to change station.

(p) Officers will report to organization headquarters the names of men who are alien enemies or aliens by birth and whom it is not considered in the best interests of the service to be sent on duty abroad.

(q) Officers will upon receipt of orders at once notify the Depot Quartermaster in writing by special messenger, that their organization in under orders, quoting source, number and date, and requesting that this branch office be notified to expedite issues and settlements of accounts.

(r) Property for shipment abroad should be marked as follows: "General Superintendent Army Transport Service .....(giving port of embarkation). No unauthorized equipment will be allowed to be transported to Europe.

This address to be followed by marking, indicating the particular corps of department of the army for which intended including the words "American Expeditionary Forces France." If not intended for General Supply marking should be included in (thus for Quartermaster Corps American Expeditionary Forces) "For Laundry Plants" or "For Shoe Repair Shops" or "For Motor Transport Repair Shops" or "For Base Depot....." if known. There should also be—included in—the marking a general statement of contents of each package thus "Toilet Soap, Carbon 30 inch Searchlight, Telegraph Sounder" and the shipment number, the number of packages in the shipment, the particular number of each package, the weight of each package, and the volume of each package, in cubic feet.

(s) Q. M. C. 471, printed complete below, will be sent to organizations by Depot Quartermaster after notified that movement is ordered. Its provisions must be strictly complied with by the organization commander.

1. Freight cars will be place on siding.....
- Baggage cars will be placed on.....
- Passenger equipment will be placed on.....

Organization commanders should mark the cars with chalk with the letters of the organization to which they are assigned.



This avoids delay and confusion. Passenger cars will not be marked until after train sections are made up.

2. The kind and weight of all property loaded in each car must be shown. To accomplish this, when organizations take their property with them, a competent non-commissioned officer should be assigned to each car with instructions to make a list of boxes, barrels, crates, bundles, etc., and the weight of each. Separate lists of property should be made for each organization. The number of the car and the initials of the line to which it belongs must be shown on each list. These lists should be collected by the organization commander and brought to this office in ample time to have the bill of lading made out. If time admits, the organization commander should consolidate the lists and make up a shipping invoice in duplicate on Form No. 201 Q. M. C., for his train section. The shipping invoice should contain lists of property for each organization, separately stated, the total weight of the property, the number of vehicles and the number of animals, and must show the number and initials of the car into which the property of each organization or of officers has been loaded. The list or shipping invoice should be complete in every detail, so that the shipping quartermaster can make up his bill of lading without delay. The organization commander must also submit a list giving the names of owners of authorized private horses, the number owned by each, and also the number of horses in excess of the authorized number, if any.

3. All officers and non-commissioned officers shipping household goods must submit to the shipping quartermaster's office at the earliest practical moment an accurate list of shipping invoice of all property turned over by them for shipment. These lists should be made out on Q. M. C. Form No. 201 and must show the weight put into each car, the car number and initial, and if for over-seas shipment, the number of cubic feet must be stated. The following papers must be attached in duplicate to the above lists or shipping invoices.

- (1) Certificate of professional books.
- (2) Certificate of authorized private horses.

In case of duty beyond the seas, the following additional certificate in duplicate must also be submitted covering:

- (1) Weight of property going with officer.
- (2) Weight shipped home or to other point for storage.
- (3) Weight left at this post for storage.

Blanks for these certificates can be obtained at this office.

4. Where the organization takes its property on the same train or other conveyance the property is only constructively turned over to the shipping Quartermaster. The organization commander supervises and checks the loading of it upon the cars also supervises and checks the property from the cars at the destination. The only duty of the shipping Quartermaster is to make up the bill of lading from the data furnished to him on the

shipping list or shipping invoices. In order to prevent delay in delivering the bill of lading to the last carrier at destination, it should be handed to the train Quartermaster who should not fail to properly accomplish the bill of lading and deliver it to the railroad agent at the point of destination, except that where there is an established quartermaster at destination, the bill of lading will be turned over to the latter for accomplishment, together with a statement by the train Quartermaster that all property has been received in good condition, or if there is any shortage or damage, with a statement of articles damaged, cause of damage, and the money value.

(5) The following system will greatly simplify the making up of the invoices by the officer and the bill of lading by the quartermaster.

Do not begin to number containers until everything is packed. Then put all the containers in one place, all barrels in another, etc., and number. All containers of the same kind will then have consecutive numbers. Then make up shipping invoice in the following manner:

|  |                     |
|--|---------------------|
| Nos. 1 to 60—Sixty boxes company property.....     |                     |
|  | Wt..... cu. ft..... |
| Nos. 61 to 75—Fifteen crates company property..... |                     |
|  | Wt..... cu. ft..... |
| Nos. 76 to 80—Five bundles clothing etc.....       |                     |
|  | Wt..... cu. ft..... |

If shipping invoices are made up in this way, it makes much less work for all concerned. The number of cubic feet is necessary only for over-seas shipments.

(6) Lockers are classed as checkable baggage and are checked free. They must be loaded in baggage car or in box car assigned as baggage cars. BAGGAGE should not be loaded in cars with other freight. Checkable baggage not exceeding 150 lbs., per passenger is carried free by the railroads, and therefore the weight should not be included with weight of other baggage.

(7) The organization commander, or other officer especially detailed for the purpose, should superintend the loading of the property on the cars to see that it is loaded as compactly as possible, and that the proper record is kept and turned over to the shipping Quartermaster promptly.

(8) Quartermasters and commanding officers of organizations should see that a tag is placed on freight doors showing what is in the car and to whom it belongs. Example: "Equipment Troop A, 1st Cavalry;" Forage Quartermaster, 1st Cavalry."

(9) The quartermaster of the entire command should submit a list to the shipping quartermaster giving the following information for each section:

(1) Number of officers (including medical officers).

(3) Number of civilians traveling on Government transportation.

(5) Number of stock attendants.

(10) The train quartermaster should verify the numbers of men on the train without delay. It frequently happens that all the men scheduled for a section do not get on the train, and the quartermaster of the section should, therefore, obtain his tickets so that he can deliver to the conductor the exact number of tickets for the men on the train. For Example: Supposing the command consisted of 300 and transportation request had been obtained for that number, the quartermaster of that section should get one railroad ticket calling for 200 men and 100 single tickets? The necessary number of tickets can be withheld for any men who fail to get on the train.

In case a railroad agent should be placed on the train it may be possible to make arrangements whereby the transportation request could be held until the quartermaster checks up the train and obtains the exact number of men entitled to transportation. The receipt on the transportation request could then be filled out for the exact number and delivered to the agent.

I certify .....

has been furnished by.....

for ..... in addition to the ..... called for

State No.

on transport request No..... Issued by.....

for..... en route from.....  
 State Command.  
 to ..... per .....  
 Date..... 191  
 .....  
 .....

Commanding.

Copy of certificate should be sent to distributing quartermaster settling the accounts, or, if his address is not known, to the shipping quartermaster to be forwarded by him.

(12) In case the railroad company furnishes a kitchen car, the quartermaster of the train should keep account of the ice used in the car as he will be required to furnish certificate for the amount used during the journey on form Q.M.C. No. 157.

(13) Rates on sleeping car accommodations are figured to include the time of arrival at the destination. If the cars are held beyond a reasonable time for the troops to detrain, there will be an extra charge for the service and the commanding officer of the section should furnish the sleeping car conductor in charge a certificate in the following form:

..... 191  
 Place

I certify that my command arrived at this place.....  
 o'clock..... That I held the men on the cars for the  
 following reasons .....

.....  
 That the command detrained at.....o'clock ..... 191  
 having occupied the cars.....hours.....minutes after  
 arrival. That the service was necessary and just and is a  
 proper charge against the United States.

The service was rendered by.....Company  
 in connection with Transportation Request No..... issued by  
 ..... Quartermaster at.....

.....  
 .....  
 Commanding.

Copy of this certificate should be forwarded by the command-  
 ing officer to the disbursing quartermaster settling the accounts.

(14) If movements are made under contracts with the railroads  
 company, the train quartermaster should obtain copy of the con-  
 tract of sufficient data therefrom to enable him to know what is  
 required of the R.R. en route.

Before leaving the initial point he should make a careful list  
 of all the freight car numbers and the initials of the cars. This  
 for use in case any cars should go astray. Cars should be verified  
 frequently en route.

(15) If there is any unusual delay en route, the commanding  
 officer should at once communicate by wire with the division  
 superintendant of the railroad company, advising him of the  
 delay and requesting prompt action relative to forwarding.



(16) In case of movements over sea, the quartermaster of command will furnish a consolidated list or shipping invoice of property accompanying the command to the quartermaster in charge of transports.

This list must show the number, kind, weight, and cubic measurement of packages, as outlined in paragraph 5 hereby; also the organization or name of officer to whom it belongs.

The property will be only constructively turned over to the quartermaster in charge of transport, but will be stored on the ships, under the direction of the quartermaster in charge of transports.

The property will be listed in the ship's manifest under direction of the quartermaster in charge of transports.

(t) Par. IV. G.O. 13, W. D., Feb. 8, 1918, prescribes the following in regard to company records, for organizations ordered overseas:

1. Prior to entraining for the port of embarkation, company and detachment records will be so prepared for shipment that they will be readily accessible at all times throughout the entire journey to Europe. The company or detachment commander will leave behind the service record, complete to date, of each man left behind, and will furnish promptly to the proper officer the service record of each man transferred or detached after the journey begins.

2. All officers authorized to detain men from organizations destined for overseas service, will obtain, in each case, from the commanding officer of the soldier concerned, at the time of such detention, the service record of the men so detained. In any case where it is impracticable to comply with this provision, the officer detaining the soldier will at once submit to the Commanding Officer, Port of Embarkation, an explanation stating why it was impracticable to obtain the service record.

#### Part 4

### CLOTHING AND EQUIPMENT FOR OFFICERS

The following War Department Bulletin is the latest information relative to clothing and equipment which should be in the possession of an officer for field service in France:

BULLETIN

WAR DEPARTMENT

No. 2.

Washington, January 25, 1918.

The following is published to the Army for the information and guidance of all concerned:

List of Arms, Equipment and Clothing which should be in the possession of an officer for field service in France, based on Table of Fundamental Allowances, Quartermaster Supplies; Uniform Regulations; and, Circular of information issued from Headquarters, American Expeditionary Forces, dated November 16, 1917.

| <i>Articles</i>  | <i>No.</i> | <i>Remarks</i>  |
|--|------------|---|
| Basin, Canvas .....                                    | 1          | Sold, not issued to officers.   |
| Bedding-roll or a combination bedding-cloth-roll ..... | 1          | Sold, not issued to officers.   |
| Belt, Saber, garrison....                              |            | Sold, not issued to officers.<br>See par. 65, U. R.<br>Circ. Hdqr's A.E.F. states: "In addition to the prescribed field belt, the Sam Browne belt with single sling, will be needed by all officers. The proper type may be obtained in France." Also see Sec. 1, Bul. 70, WD, 1917.<br><i>Note:</i> The "Sam Browne" or "Liberty" belt is not authorized to be worn in this country. |
| Belt, waist .....                                      | 1          | Sold, not issued to officers.   |
| Blankets, olive drab....                               | 4          | Sold, not issued to officers. This is number given in circ. Hdqrs. A. E. F.   |
| Boots, rubber, hip.....                                | 1          | Sold, not issued to officers. Circ. Hdqrs. A. E. F.   |
| Breeches, woolen, pairs..                              | 2          | Circ. A. E. F. states clothing should include heavy and medium weight. Sold to officers.  |
| Bucket, canvas .....                                   | 1          | Sold, not issued to officers.   |
| Canteen, with cover and strap .....                    | 1          | Issued by Q. D., on memo receipt.   |
| Cap, service .....                                     | 1          | Circ. A. E. F., sold to officers.   |
| Chair, camp .....                                      | 1          | Circ. A. E. F., sold to officers.   |
| Coats, service, woolen...                              | 2          | Circ. Hq. A. E. F. states clothing should include heavy and medium weight. Sold to officers.  |
| Collars, linen, white....                              | 12         | Circ. Hq. A.E.F. Sold to officers.  |
| Comfortable .....                                      | 1          | Circ. Hq. A.E.F. Sold to officers.  |
| Compass .....  | 1          | Sold to officers. Hq. A. E. F. suggests illuminated dial. Sold to officers.   |
| Cuffs, linen, white, pairs.                            | 6          | Circ. Hqs. A.E.F. Sold to officers.   |
| Cup .....  | 1          | Sold, not issued to officers.   |
| Drawers, pairs .....                                   | 4          | Sold, Circ. Hqs. A. E. F. states, heavy wool and cotton.  |
| Field Glass .....                                      |            | Sold by Signal Corps; not issued to officers.   |
| First Aid packet, with pouch.....                      | 1          | Supplied by Medical Department.   |

| <i>Articles</i>                                | <i>No.</i> | <i>Remarks</i>  |
|--|------------|---|
| Flashlight and Extra batteries .....           | 1          | Circ. Hdqrs. A. E. F.   |
| Fountain pen, paper and envelopes .....        | 1          | Circ. Hdqrs. A. E. F.   |
| Gloves, riding, pair.....                      | 1          | Sold. Circ. Hdqrs. A. E. F.   |
| Gloves, woolen, olive drab, pair .....         | 1          | Sold, not issued to officers.   |
| Handkerchiefs .....                            | 12         | Sold. A number should be of olive drab color.   |
| Hat, service, hat cord sewed on .....          | 1          | Sold, not issued to officers.   |
| Haversack, with pack carrier .....             | 1          | Containing meat can, knife, fork and spoon. Obtained from O. D. on memo receipt.  |
| Laces, shoe, extra, pairs.                     | 4          | Sold, not issued to officers.   |
| Lantern or lamp.....                           | 1          | For oil or gasoline. Cir. Hdqrs. A. E. F.   |
| Leggins, russet, leather, pig-skin, pair ..... | 1          | Sold to officers.   |
| Mocassins, pair .....                          | 1          | Sold, not issued to officers.   |
| Note book and pencils...                       | 1          | Reaching to ankle. Large enough to wear two pairs of wool stockings, worn in rubber boots. Circ. Hdqrs. A. E. F. Sold to officers.  |
| Overcoat, olive drab....                       | 1          | Sold, not issued to officers.   |
|  |            | Commanding officers may authorize <i>in the field</i> only a short double-breasted overcoat. See par. 103, U.R. Officers may wear waterproof capes or overcoats as nearly as practicable the color of the service uniform, when on duty involving exposure to rainy or other inclement weather; see Par. 126, U.R. In France the overcoat is worn of knee length. Circ. Hdqrs. A. E. F. states it is desirable to have the overcoat lined. See "Slicker." |
| Overshoes, arctic, pair...                     | 1          | Circ. Hdqrs. A. E. F.   |
| Pistol, with holster.....                      | 1          | With 21 rounds of ammunition, obtained from O.D. on memorandum receipt.   |
| Pistol, belt .....                             | 1          | Obtained from O.D. on memo receipt.   |

| <i>Articles</i>                                  | <i>No.</i> | <i>Remarks</i>  |
|--|------------|---|
| Portfolio, leather . . . . .                     | 1          | For officers habitually carrying papers. Sold.  |
| Saber and scabbard . . . . .                     | 1          | Circ. Hdqr's A.E.F. states required only by cavalry officers on duty with troops armed with the saber. Sold, not issued.  |
| Saber, knot . . . . .                            | 1          | Sold, not issued to officers. See remark above concerning wearing of the saber in France.   |
| Shelter, tent, complete. ♀.                      | 1          | Issued on memo receipt by Q.M.D.  |
| Shirts, flannel, olive drab                      | 2          | Sold, not issued to officers.   |
| Shirts, cotton, olive drab<br>or linen . . . . . | 6          | Sold. Circ. Hdqrs. A. E. F.   |
| Shoes, high, russet<br>leather . . . . .         | 2          | Sold, not issued to officers. Circ. A. E. F. states that two pairs of shoes are required for wear inside arctic overshoes; and also the following are required: two pairs very heavy hob nailed field shoes, or trench boots large enough to take heavy wool stockings. These boots should be laced in instep, and such boots may be worn by all officers at all times. Those laced all the way up are authorized; but in cities, they may be worn only in inclement weather. Mounted officers may wear boots of russet leather. See Par. 67 U.R.         |
| Slicker . . . . .                                | 1          | Sold not issued to officers. Circ. Hdqrs. A.E.F.: "It is advised that the Slicker have a detachable lining of heavy wool or fleece." "The overcoat and raincoat 'Slicker' for officers in the trenches should be of same appearance as those worn by the men. The English trench coat is satisfactory provided it can be obtained. It answers the combined requirements of overcoat and raincoat and has a lining that can be worn separately."<br><i>Note:</i> A trench coat very similar to the one above described is manufactured by Adler Brothers & |



| <i>Articles</i>                          | <i>No.</i> | <i>Remarks</i>  |
|--|------------|---|
|  |            | Co., of Rochester, N. Y., and one is on sale at the Army & Navy Co-operative Stores. It is thought there are several manufacturers who make them. Correspondence with the Depot Q.M., New York, will secure names of possible manufacturers.                                |
| Stockings, pairs .....                   | 6          | Sold not issued to officers. Circ. Hdqrs. A. E. F. states that cotton and heavy wool underwear are required, and particularly indicates that heavy weight wool stockings are needed. To meet these requirements the number indicated should be increased; at least doubled. |
| Tag, identification .....                | 2          | Sold, not issued to officers.   |
| Tape, for identification tag, yard ..... | 1          | Sold, not issued to officers.   |
| Toilet articles .....                    |            | Including brushes, hair and tooth; comb, razor and soap. Sold, not issued.  |
| Toque, knitted .....                     | 1          | Circ. Hdqrs. A. E. F.   |
| Towels .....                             | 6          | Including bath towels. Sold.  |
| Tub, canvas or rubber...                 | 1          | For sponge bath. Circ. Hdqrs. A. E. F.  |
| Undershirts .....                        | 4          | Sold, not issued to officers. Circ. Hdqrs. A.E.F. states that cotton and heavy woolen underwear are required, so this number should be at least doubled.  |
| Vest, leather or flannel..               | 1          | Circ. Hdqrs. A. E. F.   |
| Watch .....                              | 1          | Sold to officers by Signal Corps.   |
| Whistle .....                            | 1          | Issued by Q.M. on memo receipt.   |

Mounted officers will provide themselves with spurs, and the necessary horse equipment.

The Depot Quartermaster in New York will furnish, on application, officers with a list of manufacturers of clothing and equipment.

Upon request of officers, the manufacturers on such list will

forward to them a price list, and will deliver clothing and equipment to officers ordering same, collecting from the officers the wholesale prices for the articles furnished.

(062.1, A.G.O.)

By order of the Secretary of War,

JOHN BIDDLE,

Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCain,

The Adjutant General.

### BAGGAGE ALLOWANCE

For a Major, the allowance is not to exceed 400 lbs.

For each officer below the grade of Major, baggage not to exceed 250 lbs. This allowance includes professional books, equipment "C" and all necessary clothing and bedding for extended field service.

Containers for personal baggage for officers, the standard trunk locker and bedding rolls or their equivalent in similar containers:

Field allowance of baggage is given in A. R. 1123 and 1136 as modified by telegram No. 7323, W. D., June 25, 1917. The latter provides:

(a) That the allowance prescribed for grades above Captain shall cover everything necessary;

(b) That the allowance for grades below Major, and for contract surgeons, acting dental surgeons, and veterinaries, shall be 250 lbs. and shall cover everything necessary, except horse equipment.

Officers should bring the professional books, papers and manuals that they consider most important. Steel helmets and gas masks will be supplied in France. All containers should be plainly marked or stenciled with officer's name rank and organization. The transit of baggage should, as far as practicable, be looked after personally.

**These Suggestions as to Officers Equipment are Offered by  
a First Lieutenant of the 18th Infantry, After Four  
Months Experience in France**

2 Foot lockers.

2 Pairs Shoes.

1 Pair light shoes or hip boots.

Several boxes of shoe polish.

Several boxes of saddle soap.

Writing paper.

Flash light (extra batteries).

Compass.

Trench-mirror.

Bed roll and cot.

2 Service hats (extra cords) extra collar insignia.

Supply of razor blades.

Supply of mileage and pay vouchers. Extra tooth brushes and Paste.

Extra shaving sticks. Shoe and clothes brush.

Fountain pen and ink. Candles and matches. Binder for orders.

Short Overcoat.

2 Serge suits. Issue wool. Sam Brown belts are cheaper on the other side.

Have everything stencilled and a cross or some other distinctive mark on boxes or trunks.

### **Suggestions to Officers Coming to France for Duty**

(From Army and Navy Journal).

**Olive Drab, Cotton.**—None ever used in France.

**Olive Drab, Woolen.**—Suits made here extra heavy English cloth, now cost about \$65, and take about a month to make.

**Overcoats.**—Very warm needed. The sheep-lined short coat very good, but may have to be destroyed if it gets infected. A raincoat necessary. In Paris one can buy a raincoat with a linen silk lining that is waterproof. It has a woolen lining that buttons fast to the inside and is removable. Can be used as overcoat when removed from inside rain coat. This can be boiled if it becomes infected. The combination serves as both raincoat and overcoat for most of the year. Price about \$55 now. Quartermaster attempting to secure stock. If secured will cost \$28.

**Hats.**—Kind required changes with conditions of service. Campaign hats, caps, and "bonnets de police" all have been or are used. Campaign hats hard to procure unless quartermaster has a supply. Caps can be bought in Paris, but no cap ornaments can be procured in France. Bonnets de police (a soft cap) can be bought here. Are cheap and can be put in pocket when change to steel helmet is necessary. Will probably be used solely in the trenches.

**Shoes and Boots.**—Very expensive here. Except for office work and rest billets, issue style is too light in weight. Very heavy soles with a sheet of rubber between the layers of the sole are desirable. A very satisfactory shoe or boot that is durable and waterproof can be bought of English makers, sole three-quarters of an inch thick. Cost about \$60 per pair. A fairly satisfactory French shoe not so durable or waterproof, costs about \$17.

Rubber overshoes little worn in trenches as they cannot be hob-nailed.

**Leggings.**—All kinds except canvas procurable in France. Cloth puttees worn some places. Leather usually worn. Cost about same as in United States. High-laced boots permitted in trenches, but not in towns.

**Socks.**—Heavy socks needed altogether. Quartermaster woolen, heavy or light, much worn.

**Underclothing.**—Medium in summer, heavy in winter. Quartermaster woolen much worn.

**Bedding Rolls.**—Warm bedding of small bulk required. Sleeping bag style desirable much of the year—bring cots. Dress suit cases or traveling bag. Staff officers and those who do duty as inspectors will need a traveling bag as they usually stop at hotels when on automobile trips.

**Sabres.**—Not used except for officers on duty with organizations armed with the sabre.

**Field Glasses.**—Required. Hard to buy here. Bring with you.

**Toilet Articles.**—Usual field style needed at front and in trenches. In billets usual home kind.

**Insignia.**—Most kinds of United States insignia are procurable in France. Eagles and General Staff collar ornaments still hard to obtain. Hat cords procurable but of poor quality.

**Shoelaces.**—Bring a supply.

**Uniform Buttons.**—Hard to procure. Quartermaster now laying in a supply.

**White Collars.**—Best use French style that buttons to the blouse. Then, heavy shirt can be worn under blouse.

**Compasses.**—Necessary. Bring with you.

**Electric Torch.**—Government can supply. Procurable in France also.

One pair extra warm gloves needed.

No chewing gum on sale here.

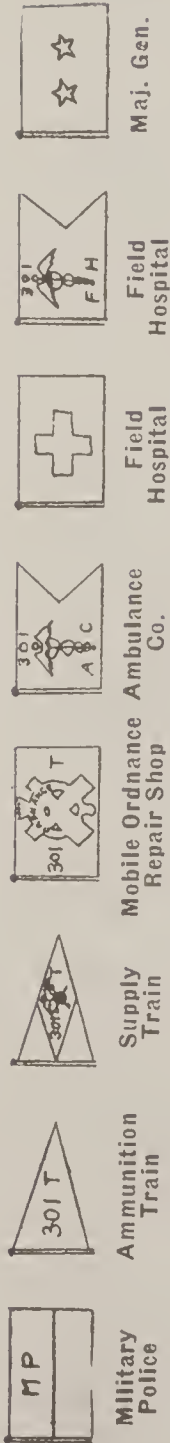
Sam Browne belt required in cities and on staff duty.

Articles sent by parcels post seem to arrive all right—limited to seven and one-half pounds. Things sent by express much delayed and difficult to get from express office in Paris to consignee.

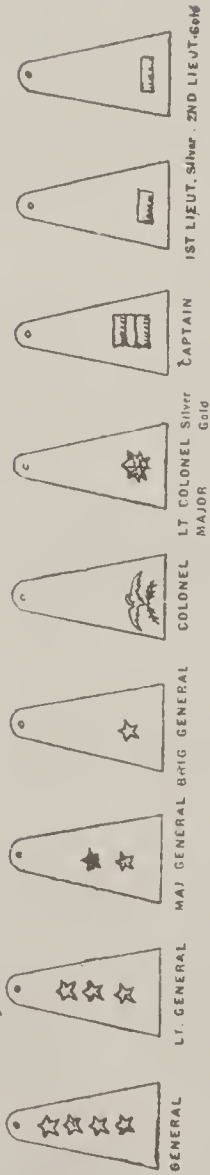


# Part 5 INSIGNIA

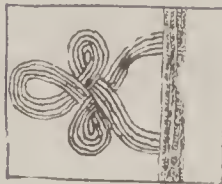
## DISTINCTIVE MARKING FLAGS FOR MOTOR VEHICLES OF TRAINS



## INSIGNIA OF RANK ON SHOULDER LOOPS OF COMMISSIONED OFFICERS

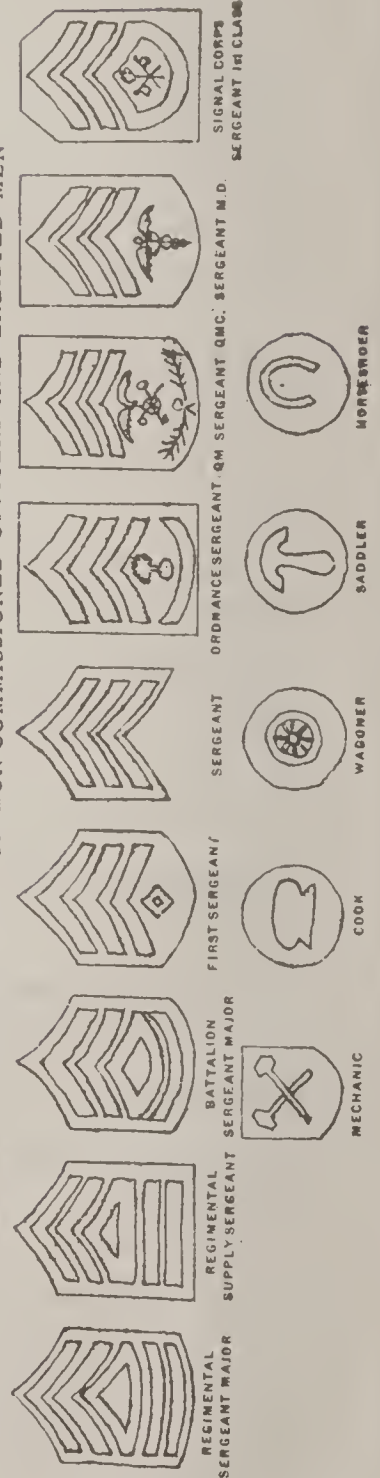


## OVERCOAT SLEEVES

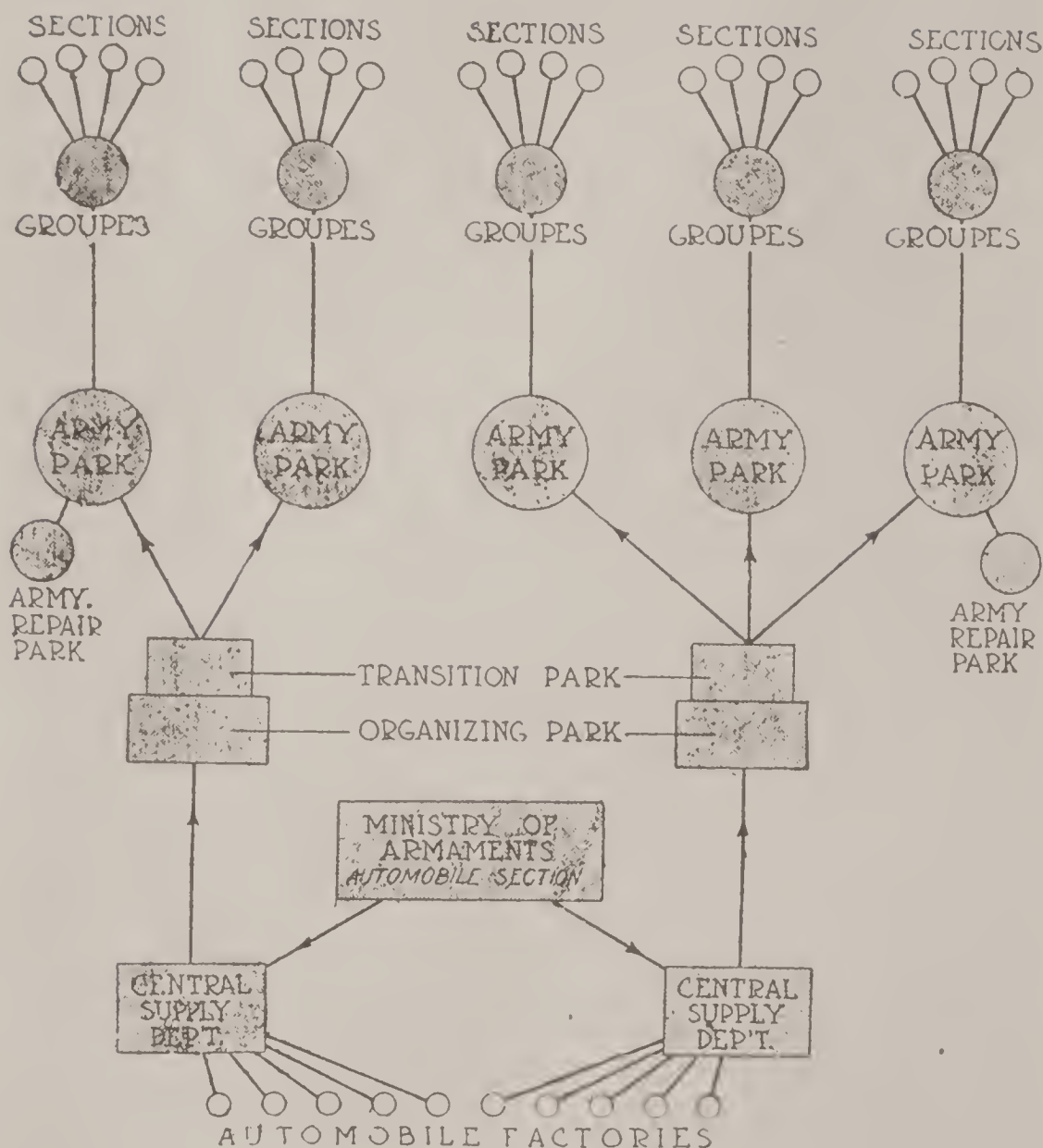


GENERALS HAVE STARS OF RANK  
COLONEL 5 STRIPES OF BRAID  
LT. COLONEL 4 " " "  
MAJOR 3 " " "  
CAPTAIN 2 " " "  
FIRST LIEUT. 1 STRIPE " "

## CHEVRONS AND SLEEVE INSIGNIA OF NON-COMMISSIONED OFFICERS AND ENLISTED MEN



## Part 6



Diagrammatic outline of the French system of motor truck supply, showing the organization which has been built up between the factories producing the vehicles and the units in the field that make use of them. The system includes two Central Supply Departments, one being in the neighborhood of Paris and the other in the Lyons district

### FRENCH SYSTEM OF TRUCK SUPPLY

*Delivery from Manufacturer to Civil Department, Thence to Military Headquarters, Finally to Point of Use*

Between the factory which produces automobiles and the units which make use of them in the field it has been necessary to build up an organization which at first sight looks complicated. Cleared of many of its details, such an organization is shown

in the accompanying diagram. Orders for automobile material come from the Automobile Section of the Ministry of Armaments, which acts through the Central Supply Departments. There are only two of these departments in France, one being in the neighborhood of Paris and another in the Lyons district. Acting on instructions from the Ministry, the Central Supply Departments place the contracts with the factories and take delivery of the goods. The detailed work of this department, is more elaborate than would appear at first sight. Trucks are not always received complete, but in chassis form, or lacking many of the necessities for war service. The Central Supply Department equips them either in its own shops or in controlled establishments, and distributes them to an organization in the field. Methods of delivery from the factory to the supply department have to be considered. When the two are in the same town the task is easy. But in the case of Fiat, for instance, which has its factory in Turin, Italy, and has to deliver over the Alps to a town in France, a special organization becomes necessary. Every day the Fiat factory forms a convoy of thirty to forty trucks and sends these out in charge of factory testers—one man per truck—to a frontier town 6,000 feet above sea level. Here French soldiers are waiting to drive the trucks direct to the Central Supply Department, a distance of about 150 miles. Many of the trucks are not fitted with bodies, the French preferring to do this work themselves. Thus a rough wood box to carry a load of sand is fitted, and the driver has a very light airplane seat. On reaching their destination the airplane seats are dismounted by unscrewing four bolts and handed over to a transportation agent, who returns them in lots to the factory. The boxes are not of sufficient value to be returned. This method of delivery is quicker than rail. Although there is an examination and test at the Fiat factory, the trip by road eliminates any necessity for a test at the Central Supply Department, for the total run is more than 200 miles, all over mountain roads. When the factory and the supply department are in the same town, there must be a special road test before a truck can be sent to the front.

### *Under Control of Ministry*

Leaving the Central Supply Department fully equipped for war service and manned by army-trained drivers, the trucks move up to an organizing park. All the organizations mentioned up to this point are under the control of the Ministry, and not of the army. On the next stage they pass into a Transition Park, attached to the Organizing Park, but, unlike the latter, are under army control. The Transition Park distributes the trucks to the army parks to which they will remain permanently attached so long as they are in the field. The army divisions are grouperment, groupe, and finally sections of fifteen to twenty trucks which generally work together under the control of a lieutenant.

## CHAPTER VIII

### TROUBLES AND REMEDIES

#### Part 1

### AUTOMOBILE-ENGINE TROUBLES

#### STARTING AND RUNNING DIFFICULTIES

#### SYMPTOMS, CAUSES AND REMEDIES

1. **Diagnosing Troubles of Automobile Engines.**—To manage successfully an internal-combustion engine.—especially one that works under such a variety of conditions, often very severe, as the automobile engine—it is first of all necessary for the operator to make good use of his reasoning faculties.

The symptoms of derangement, when taken singly, are often such as may be caused by any one of several possible defects. In nearly every case the defect, whatever it may be, will produce several symptoms, a careful study of which will lead to the elimination of causes that do not tally with all the symptoms; as, for instance, causes affecting all cylinders when only one or two are misbehaving, or vice versa. When the user has reached this point, generally a short further investigation of the points at which trouble of that particular sort is most likely to occur will lead him to the discovery of the true cause. The cause of loss of power, due to such faults as a loose battery connection, a sticking inlet valve, or a bit of dirt in the carbureter, will at once be recognized in its true character by the experienced operator. The only way to attain final proficiency in these things is by extended experience with the particular engine in hand; but, on the other hand, there is no excuse for the aimless groping of many inexperienced users, who will often send needlessly for a tow, or will pull an engine to pieces in their search for some simple fault that might be located by intelligent diagnosis.

2. **Causes of Refusal to Start or of Sudden Stoppage.**—The fundamental reasons for an engine refusing to run or a particular cylinder refusing to work may be summed up as due to (1) no spark, (2) no mixture, or (3) wholly wrong mixture. These cover all the possible causes, which may be enumerated as follows:

1. Switch not closed.
2. Gasoline not turned on.
3. Carbureter not primed, or (rarely) primed too much, or flooded.
4. Weak battery.



5. Gasoline stale or mixed with kerosene.
6. Gasoline too cold to vaporize.
7. Dirt or waste in carbureter or gasoline pipe.
8. Mud splashed into air intake.
9. Water in carbureter.
10. Soot on the spark plug or contact igniter.
11. Water on spark plug or contact igniter.
12. Broken spark-plug porcelain.
13. Grounded wire (generally secondary).
14. Broken wire (generally primary) or loose connection.
15. Very bad adjustment of the coil tremblers.
16. Defective spark coil or condenser (rare).
17. Broken igniter spring.
18. Defective high-tension circuit
19. Broken valve stem, spring, or key.
20. Valve cams slipped (rare).

3. **Causes of Irregular Firing or Misfiring.**—The principal cause of misfiring is irregular sparking which may be due to a variety of causes. Irregular sparking may be caused by the following:

1. Spark plugs or contact igniters defective or covered with soot.

2. Weak battery.

3. Broken wire, making intermittent contact through the vibration of the car (generally found in the primary circuit).

4. Loose connection at a binding post or anywhere in the primary or low-tension circuit.

5. Wire occasionally grounded through vibration of car. This is generally found in the secondary circuit, and it is not necessary for the bare wire to make contact with the metal into which this secondary current is escaping. If the insulation of the secondary cable is weakened and the cable is lying loosely on a metal part, the spark will often jump through the insulation.

6. Timer contact surfaces roughened by sparking.

7. Wabbling or defective timer.

8. Poor trembler adjustment.

9. Trembler sticking at high speeds, due to inertia of heavy armature.

10. Insufficient pressure on timer contacts.

Some other causes of irregular firing are as follows:

1. Valve spring weak or broken.

2. Sticking, binding, or broken valve, or one badly in need of grinding.

3. Particle of carbon under valve.
4. Spray nozzle closed intermittently by loose particles of dirt, etc.
5. Air valve of carbureter sticking or binding.
6. Mixture too rich or too lean.
7. Lubrication excessive or oil not suitable.
8. Water in cylinder on account of cracked or porous cylinder, or loose plug in cylinder wall.

A sticking inlet valve, which stays open when it ought to close, will cause irregular firing and occasionally back firing.

A very lean or a very rich mixture may be ignitable only by a strong spark. It can always be distinguished from ignition troubles by the fact that the explosion impulses, when they occur, are of less than normal strength. If the mixture is too weak the explosions are likely to occur every other cycle. If the mixture is too rich, there will sometimes be explosions in the exhaust pipe and muffler; if it is too lean, there will ordinarily be back firing into the carbureter.

**4. Causes of Weak Explosions.**—The causes of the explosions being weak are briefly as follows:

1. Mixture too lean or too rich.
2. Leakage of compression.
3. Mixture diluted with exhaust gases.
4. Spark timing later than it should be, in one or all cylinders.

If the trouble is in the mixture, the explosions are regular, unless the mixture is so defective that it sometimes fails to ignite in spite of the spark occurring regularly. The same will be true in any case where, as is usual, the cause of the weakness is unconnected with any irregularity in sparking.

The causes of weak explosions may be enumerated more fully as follows:

1. Dirt or waste in carbureter or gasoline pipe, causing weak mixtures.
2. Stale gasoline.
3. Air intake partly obstructed, causing rich mixture.
4. Bad carbureter adjustment.
5. Trouble with float.
6. Choked muffler.
7. Lack of oil on piston, or oil that is too thin.
8. Leak through valve (generally the exhaust valve).
9. Leaky spark plug.
10. Valve timing wrong. This is most likely due to the fact that the cam-shaft, etc. have been taken out and replaced

with the gears in incorrect angular relation. It may, however, be caused also by wear of the cams, push rods, or valve stems, by spring in the cam-shaft or valve lifters, or by the slipping of cams.

11. Broken or worn piston rings.

**5. Causes of Failure to Keep Engine Going.**—If the engine starts, but soon slows down and finally stops, the trouble may be due to any one or a combination of the following causes:

1. No fuel in tank.
2. Fuel does not flow freely to carbureter, the piping being clogged or the vent hole in gasoline tank being closed.
3. Broken connection in fuel supply pipe.
4. Valve closes suddenly in gasoline supply pipe.
5. Water in carbureter.
6. Weak battery.

**6. Causes of Sudden Stoppage of Engine.**—If an engine has been running well and stops suddenly, and the cause of the trouble is known not to be due to breakage of an important part, the following causes may be looked for:

1. Fuel tank empty.
2. Dirt in carbureter.
3. Primary wire broken or short-circuited.
4. Vibrator stuck in a single-cylinder or master-vibrator ignition system.

**7. Causes of Back Firing Into Carbureter.**—If explosions occur in the carbureter, the probable causes are:

1. Mixture too lean.
2. Inlet valve binds or valve spring is weak.
3. In a two-cylinder engine with the spark plugs in series, back firing may be due to retarding the spark excessively when starting the engine.

**8. Causes of Slow But Constant Decrease of Power.**—The most probable causes of the power of an engine decreasing slowly and constantly are the following:

1. Vent closed in fuel-supply tank, provided it is of the gravity type.
2. Insufficient pressure in compression fuel tank. This may be due to a leaky or binding check-valve in the compression pipe, or to the tank not being tightly closed.
3. Valve gradually jarred shut in the fuel pipe.
4. Poor compression on account of a valve becoming leaky in a single-cylinder engine.

**9. Reasons for Failure of Engine to Develop Full Power.**—

A failure of the engine to develop its full power should not be confused with frictional resistance in the transmission system, or dragging brakes. The chief reasons for this trouble in the engine itself are:

1. Back pressure on account of a choked muffler. Opening the muffler cut-out or relief valve will at once indicate whether or not this is the cause of the trouble.
2. Lubrication insufficient, especially in the cylinder.
3. Overheating.
4. Compression leaks at the valves, around the piston, or through a porous cylinder wall or a loose cylinder plug.
5. Particles of carbon or other dirt under a valve.
6. Valves not properly timed.
7. Mixture too rich or too lean.
8. Ignition spark weak on account of weak battery. The spark does not always occur early under this condition.
9. Water entering cylinder from water-jacket.
10. Timer slipped on shaft, causing late spark.

**10. Reasons for Engine Not Running Slowly and Pulling the Car.**—It sometimes happens that an engine will run at high speed and pull the car, but will fail to pull the car when slowed down. The probable reasons for such behavior are as follows:

1. Carbureter not adjusted properly.
2. Magneto magnets weak, or magneto not speeded to suit the engine.
3. Compression in the cylinders poor.

**11. Causes of Engine Not Running at High Speed.**—If it should be found that an engine will run well at low speeds, but cannot be speeded up to high speed, the probable causes are the following:

1. Carbureter not adjusted properly, or not receiving fuel fast enough.
2. Weak battery.
3. Vibrator of igniter too heavy or set too tight to respond quickly to the action of the primary current.
4. Timer defective.

## KNOCKING OR POUNDING

**12. Mechanical Causes of Knocking.**—Undoubtedly the sense of hearing is more useful in detecting irregularities in the running of an engine than any other sense. By means of the sounds produced, the engine talks to the operator, and with a little intelligent study he will soon understand the



language. Even at a distance it is often possible to tell whether an engine is running regularly or whether, as indicated by the sound of the exhaust, some of the charges admitted to the cylinder are expelled without being exploded. Standing in close proximity to the engine, the operator may distinguish a variety of sounds indicating defects about the engine and calling attention to the necessity of applying proper remedies at the first opportunity. By opening the muffler cut-out, provided the engine is fitted with one, any irregularity in the running can be more readily detected.

13. Knocking in automobile engines may be due to looseness or rattle in some external part, owing to nuts having worked loose or to bolts being sheared off or being too small for their holes. Knocking due to such causes is readily detected by a careful inspection while the engine is running. This inspection may be aided by laying the hands on parts suspected of being loose, when vibration will easily be felt; also by careful scrutiny with an electric flashlight for evidences of movement where two parts are bolted together.

About the most likely place to find looseness of this description is in the holding-down bolts that secure the engine to the frame on which it is mounted; but in certain horizontal engines it may also be found that the caps over the main bearings are loose, owing to the fact that they have not been properly tongued into the bottom halves or pillow-blocks of the bearings. Looseness at either of these two points should be remedied in the repair shop, as it always necessitates the substitution of larger bolts, aided perhaps by dowel-pins; and in the case of the bearing cap it may be necessary to make an entirely new cap, with proper tongues fitting into grooves that must be machined or chiseled in the pillow-block.

14. A prolific cause of knocking is looseness due to wear in the bearings of the main shaft, the crankpin, or the wristpin. In a four-cylinder vertical engine, the main-shaft bearings may be quite loose without causing a knock, because the weight of the shaft and the flywheel holds the shaft down; but a horizontal engine will, under certain conditions of speed and load, pound with a small amount of looseness. Only a very limited amount of looseness should be permitted in the main-shaft bearings of any engine, both on account of the danger of springing the shaft and because a bearing worn beyond this extent is liable to begin cutting, as it is difficult to keep sufficient oil in such a bearing.

15. Looseness in the flywheel bearing of a vertical engine is disclosed by putting a jack or a lever under the flywheel and working it gently up and down. In the case of a horizontal engine it is necessary to move the shaft approximately in line with the pressure of the explosions, and a lever will have to be applied to the flywheel or shaft in whatever manner seems most practicable. Occasionally, looseness of the shaft can be

detected by rocking the flywheel back and forth against the compression in the cylinder. If the pull of the sprocket chain comes on the engine shaft, looseness in the adjacent bearing may possibly be detected by alternately stretching and relaxing the chain, which can be done by grasping it midway between the sprockets and pulling it up and down as far as it will go.

Another very good way to disclose looseness in the main bearings of any car having a planetary transmission gear on an extension of the engine shaft is to tighten one of the friction bands of this gear by the appropriate lever, usually the low-speed or the reverse lever. It very rarely happens that the tension of these bands is exactly balanced, so as to impose no radial pull on the shaft. Tightening the band will move the shaft to whatever extent the adjacent bearing has worn.

A novice should not attempt to refit the main-shaft bearings, as this operation requires a great deal of skill and experience for its correct execution.

Wear in the crankpin bearings is disclosed by setting the cranks at about half stroke and then rocking the shaft back and forth.

16. Knocking in the wristpin, due to wear of the pin and its bushings, is not among the more common troubles and does not need to be taken care of at once unless aggravated. It is well, however, not to neglect this trouble too long, as the bushings and the pin will be worn out of round so badly that they cannot be used. A good engine will run a car many thousand miles before any replacement is demanded at this point. When it is taken out, the wristpin should be calipered all around. If it is out of round, it should be ground true; or, if this is impracticable, a new pin will have to be supplied and the bushing reamed or scraped to fit. This, of course, should be done in a repair shop.

17. Knocking is occasionally due to the wristpin and the crankpin not being exactly parallel. This causes the connecting-rod to oscillate from end to end of the wristpin and crankpin bearings; and if, as is customary, there is one-sixteenth or more of end movement in these bearings, the knocking may be very noticeable. If, as is likely to be the case, it is impossible to make the pins parallel, the only recourse is to take up the lost motion at the end of one or the other bearing, and possibly both bearings, by the use of washers or cheeks soldered to one end of the bushing and brasses. This cause of knocking is not common, particularly in the better class of engines.

18. The best construction is to secure flywheels to short shafts by bolting them to flanges instead of keying them. Sometimes, however, a flywheel is held on by a common key or by two keys 90° apart, and frequently it will work loose on its keys. This will inevitably result in a knock, which will be very loud if the engine has fewer than four cylinders. The crank-

case should be opened and the cranks blocked so that the shaft cannot turn; then force should be applied to the flywheel to disclose the looseness, if any. Sometimes the flywheel will be so tight on its shaft as to resist turning in this manner by using any ordinary force. In this case, it is best to take the car to a repair shop if a thorough search has failed to disclose any other cause of the noise.

A sprung shaft will always cause knocking, and also rapid wear and cutting of the bearings.

**19. Combustion Knocks.**—Besides the mechanical causes of knocking, there is a class of knocks that may be called combustion knocks. Such knocks are altogether distinct from the preceding, in that they may occur without appreciable looseness in the bearings. They are due to excessive rapidity of combustion, coupled generally with too early ignition, the charge being completely burned before the piston has reached the end of the compression stroke. The most obvious cause of combustion knocks is too early ignition, as when running up a hill without suitably retarding the spark. A contributing cause is a slightly weak mixture, because a mixture of this kind burns faster than a normal or overrich mixture. Pounding in particular cylinders of a multicylinder engine may be due to unequal rapidity of combustion, which itself may be due to unequal charges, as when the valves are unequally timed, or to irregular spark timing, such as may result from a wabbing timer or badly adjusted vibrators. If the timer contact surfaces have been roughened by sparking or by wear, they will cause the contact maker of the timer to jump when running fast, and therefore to make erratic contact, resulting in irregular firing. The knocks are not necessarily violent, and they may sound a good deal like the knocks due to loose bearings, except that, if caused by faulty action of timer or vibrators, they will occur irregularly.

**20.** Pounding due to too early ignition is not always due to failure to retard the spark; in fact, a partly compressed charge may often be ignited before the spark occurs by coming into contact with incandescent particles of carbon that adhere to the combustion chamber or piston head. This defective action is called *preignition*. Preignition may also be caused by insufficient cooling of the cylinder, due to a shortage of cooling water, to portions of the water-jacket becoming filled with deposits of any kind, or to improper circulation of the water, any one of which will be indicated by the boiling of the water or by the smoking of the exterior of the engine.

Imperfections in the surfaces of the combustion chamber—such as sand holes or similar cavities, and small projections on any surface exposed to the heat of combustion—or parts that are not sufficiently cooled while the engine is running under a fairly heavy load, may also cause preignition.



21. Premature ignition manifests itself by a pounding in the cylinder, and if permitted to continue, it will cause a drop in speed, finally resulting in the stopping of the engine. It will also put an excessive amount of pressure on the bearings, especially the connecting-rod brasses, and cause them to run hot even when properly lubricated. After a shut-down due to premature ignition and a short period during which the engine is idle, allowing the overheated part to cool off, it is possible to start again without difficulty and run smoothly until the conditions of load will cause a repetition of the trouble.

If the engine has two or more cylinders, and only some of them inclined to preignition, the result is that it is impossible to time the ignition correctly for all cylinders. The cylinders having a tendency to preignition must receive a late spark to prevent combustion from being completed too early, while the other cylinders will require an early spark. Thus, the engine cannot possibly be made to develop its full *torque*, or turning moment, unless it is running so fast that the tendency to preignition may be neglected.

True preignition results almost always, except at the highest engine speeds, in the charge being completely burned before expansion begins, and it is easily distinguished, especially if the engine is taking full charges, by the resulting sound, which is a sharp, metallic bing! bing! bing! closely resembling that produced by a hammer striking a block of cast iron. It is dangerous to run the engine slowly, and this is true even if only one cylinder is preigniting. If the engine is running at good speed, with an early spark, the symptoms will be those of rapid combustion in the cylinders affected, namely, a hardness in the sound of the explosion, without actual knocking, while in the other cylinders, if any, the explosion will be soft. As the speed of the engine is reduced and the spark is retarded to suit, the hard sound of the explosions gives place to unmistakable knocking. A good test for preignition due to carbon is to start the engine with everything cold, and run the car at high speed up the nearest hill before the water in the radiator has had time to get hot. The bing! bing! bing! then is a sure sign. If the carbon deposit is very great, the engine may knock when gearing up, provided this is done quickly with the engine running slowly.

22. The remedies to be applied to overcome preignition, according to the source of the difficulty, as follows: Remove the carbon deposit, plug the sand holes, or blowholes, and remove the sharp projections not intentionally made on any surface subjected to the heat of combustion; also, keep the water system full of water, clean it out if stopped up or dirty, and make sure that the water circulates properly.

A small quantity of carbon will give no trouble, but as the deposit thickens, some portions of it will remain incandescent from one explosion to the next and will ignite the fresh charge



at some point in the compression stroke, depending on conditions. The fact that the charge is not ignited until some time during compression is due to the fact that the more highly it is compressed, the more easily it will ignite. Usually, though not always, an engine that prematurely ignites the charge on account of an excessive deposit of carbon will continue to run by spontaneous ignition for several seconds after the igniter switch has been opened. If the throttle cannot be closed tight enough to stop the engine when it is running idle, it can be stopped by throwing in the clutch or otherwise engaging the transmission mechanism. The hammering due to preignition, as would be expected, is most marked when the engine is running slowly with the spark suitably retarded, and it will generally manifest itself when hill climbing, owing to the fact that the throttle is then wide open and the spark necessarily retarded to suit the slow speed of the engine.

**23. Causes of Carbon Deposit in Cylinders.**—The deposition of carbon in the cylinder is generally due to an overrich combustible mixture, an excessive amount of lubricating oil, or an unsuitable quality of lubricating oil. A deposit of carbon will sometimes accumulate gradually even when the lubricating oil is of the right quality and used in proper amount and when the combustible mixture is apparently of the correct proportions. Carbon is probably deposited on the piston head only when it becomes very hot. In such cases, the incoming mixture strikes the piston head and a portion of it is dissociated, or split up, by the high temperature of the piston, so that part of the carbon is liberated and deposited on the piston head. The carbon is deposited in two forms. One form is similar to that of ordinary soot; the other is more like coke.

**24.** Carbon in the form of coke is not generally found anywhere except on the piston head, where it collects so as to form a rough surface with small projections. This carbon is liable to become very hot and cause preignition. If a flake of the carbon breaks loose, it may lodge under the exhaust valve and thus cause a temporary loss of compression and power; or, it may work down between the piston and cylinder wall and produce a scratch, or score, on one or both.

Soft soot-like carbon is generally deposited over the entire surface of the cylinder space, except possibly the piston head. The portion that settles on the bore of the cylinder is generally scraped off as rapidly as it is deposited, either by the piston or the piston rings. The carbon that is scraped off by the piston rings mixes with the lubricating oil and sometimes collects around and under them, thus preventing their elastic action. This is especially apt to occur if the lubricating oil has a tendency to leave a gummy deposit as it is evaporated or burned in the cylinder.

Soft carbon also deposits on the spark plug to an extent that depends at least somewhat on the form and material of the insulation in the plug. If the carbon settles to any great extent on the insulation, the plug becomes short-circuited and mis-firing results. A portion of the carbon that deposits on the other parts of the wall of the combustion chamber generally does not produce any serious results until the deposit becomes thick enough to flake loose or form projections that become heated so as to cause preignition of the charge. The portion that flakes off may lodge temporarily under the exhaust valve.

In two-cycle engines, carbon sometimes collects in the exhaust ports so as to choke them. This, however, is not so likely to occur in the more modern engines with large ports as in engines with small ports and small exhaust passages. Practice has shown that many of the earlier two-cycle engines had ports and passages entirely too small for high speed.

**25. Removal of Carbon from Engine Cylinders.**—The soft carbon can be removed more or less effectively from the cylinder by means of a liberal supply of kerosene. The kerosene should preferably be put in the cylinder when the engine is hot, cranking the engine as many times as it has cylinders and permitting it to stand for some time, as overnight. If the piston is then worked back and forth or the engine rotated by hand, the soft-carbon deposit can generally be washed off completely from the cylinder walls, or it may be blown out through the exhaust if the engine is run a few minutes. It is also sometimes advisable to draw off the lubricating oil from the crank-case and put in a liberal supply of kerosene. Then, after the kerosene has been allowed to stand in the cylinders overnight, the engine should be run for a few minutes under its own power, the splashing of the kerosene serving to wash away any carbon particles that would otherwise adhere to the lower ends of pistons and cylinders. The soft carbon will also be at least partly removed in this manner from around and under the piston rings.

There are various compounds on the market that, according to claims made for them, will cut the carbon loose rapidly and effectively without injuring the parts of the engine. Some of them remove both hard and soft carbon without apparent injury to the engine.

The hard-carbon deposit on the piston head can be removed by scraping. The method of scraping depends, of course, on the construction of the engine. In some forms, a scraper can be inserted through the opening that remains after removing one of the valves. Some automobile engines are so constructed that the cylinder head may be removed without disturbing the piston and valves; in such cases, the part of the cylinder in which carbon deposits occur is readily accessible.

## Part 2

## COOLING AND LUBRICATION TROUBLES

## COOLING-SYSTEM DIFFICULTIES

**26. Lack of Water in Radiator.**—Lack of water in the radiator of the cooling system for an automobile engine is indicated by the rapid emission of steam, provided there is sufficient water to enter the engine jacket; by overheating and smoking of the engine, followed by laboring, groaning sounds, owing to the oil being burned away as fast as it is supplied to the pistons; and, if the engine still continues to run, by expansion and seizure of the pistons in the cylinders.

Trouble from lack of water is due to carelessness in not filling the tank before starting; leakage in the radiator, pump, or piping; accidental opening or breakage of the drain cock at the lowest point of the circulation system.

The remedies for trouble of this kind are apparent in inspection. If the engine becomes overheated so that the water boils rapidly away, and there is reason to think that the upper portion of the water-jacket is dry, the engine should be allowed to cool before water is added; otherwise, the sudden contraction may warp or even crack the cylinders or it may cause the cylinders to contract and seize the pistons. If the water gives out when at some distance from the nearest source of supply, the engine may be allowed to cool off and the car may then be run with the throttle nearly closed and the spark advanced as much as it will bear without knocking. This may be kept up sometimes for  $\frac{1}{2}$  mile before it is necessary to stop to cool the engine. The crank-case should be liberally supplied with oil to prevent the pistons from becoming dry, or, if a sight-feed oil cup is used on the cylinder, it should be set to feed quite rapidly. The engine should be stopped and set to feed quite rapidly. The engine should be stopped at the first sign of distress, as indicated by a groaning sound, turning with difficulty, or knocking caused by preignition due to hot cylinders.

**27. Obstructed Circulation.**—An obstruction to the circulation of the cooling water elsewhere than in the radiator will cause the bottom of the radiator to remain cool while the top is probably boiling hot.

Obstructed circulation may be caused by a broken pump, a broken driving connection to the pump, or a slipping belt or friction pulley, provided the pump is driven in this manner; by waste or some similar material that has lodged in the pump or piping; or by a piece of hose lining that has become loose and acts as a flap valve or check-valve to close the pipe partly or completely.

Air or steam in the water system sometimes prevents circulation when all, or rather nearly all, the water has been drawn



off and the system has just been refilled. If there is an air valve at the pump or in the higher portion of the water system, it should be opened to allow the air or steam to escape. Sometimes when the water has become very hot, steam collects in the pump and temporarily prevents circulation of the water. A check-valve placed near the outlet of the pump will generally prevent this occurrence, however.

When the water stops circulating, the engine naturally heats rapidly and there is a consequent decrease of power. If the engine is kept running long under this condition, some injury may be done to the cylinder and piston. In many cases, the frictional resistance to the motion of the piston may become so great that the engine will stop of its own accord.

The remedies for defective circulation of the cooling water will usually become apparent on inspection.

**28. Fan Troubles.**—A simple trouble, but one likely to be mistaken by the novice for radiator or circulation trouble, is the slipping of the fan belt. The belt should be tested occasionally, and not allowed to get so loose that the fan pulley can spin inside it. It does not have to be tight. If the fan does not run at full speed so as to draw air through the radiator and force it against the engine with sufficient rapidity, the cooling water may become so hot as to allow the cylinders to overheat.

Some types of gear-driven fans are provided with a spring-closed friction clutch, so that they will not be suddenly jerked when the engine starts. A fan thus driven may fail to run at full speed because the spring of the friction clutch either is too weak or is broken. A fan may of course stop entirely on account of a broken belt or gear.

In an emergency, as when the fan belt is lost, the fan may be driven temporarily by means of either a strong piece of cord or a piece of belt lacing. The latter, cut into strips, can be purchased from dealers in belting and mill supplies. Cord such as is used for chalk lines in carpentry or for deep-sea fishing can generally be purchased of any hardware dealer. It may be necessary to put on several separate bands of the cord or belt lacing in order to drive the fan at full speed.

If a belt slips on account of too much oil, the pulley and belt should be cleaned with gasoline.

**29.** Frequently, a belt will break at the connection between its ends. A very simple, inexpensive form of connection that can be readily carried for making repairs in such a case, or made as required, is a wire bent into a double-hook form. Three styles of such belt hooks, or fasteners, are illustrated in Fig. 1. Each form is made in four sizes. To insert a fastener, each end of the belt is pierced so as to form a hole to receive one end of the hook. This hole can be made with a small knife blade, keeping the back of the blade next to the end of the belt,



or, better, with a brad awl, or a punch. In the absence of such tools, the handle end of a file may be used. The point of the file must of course be sharp, and a wedge-shaped point will be found more suitable than a round one. After a fastener is inserted, its ends should be bent down with a pair of pliers or in any way that is convenient.

In the absence of belt hooks or suitable wire for making them, a piece of fence wire, telephone wire, or wire such as is used for baling hay and straw may prove suitable. Small soft-iron wire can also be used to fasten the ends of a belt together. In using this kind of wire, it should be run through the holes several times, in the manner of a lacing. A long, slender wire nail with the head cut off also makes a very suitable belt fastener.

**30. Scale or Sediment in Radiator.**—The presence of scale, sediment, or oil in a radiator is indicated when the whole radiator becomes unusually hot or when steam formed in the jacket forces water out of the overflow pipe of the radiator. Overheating of the radiator because of scale should not be confused with that due to a large decrease in the radiation of heat because the outside of the radiator is covered with an excessive amount of dirt or mud, nor with that due to the production of an unusual amount of heat in the engine.

Scale will deposit from hard water if the temperature of the water is allowed to approach the boiling point. A similar scale, almost impossible to eliminate, will crystallize from calcium-chloride non-freezing mixtures if these are allowed to become supersaturated.

**31.** Impure water used in the cooling system may leave either a coating over the surfaces with which it comes in contact or sediment where it has an opportunity to settle. If oil or grease becomes mixed with the water, an oily deposit will be left on the walls of the enclosing space. All these deposits reduce the cooling efficiency of the radiator.

Soft mud can be more or less completely washed out by attaching a hose to the cooling system and forcing water through it as rapidly as possible. The water should be sent through first in one direction and then in the other. There should be a free outlet from the system, so that the pressure in it will not become high enough to bulge or burst the tubes of the radiator. Ordinary dirt can also be cleaned out by a strong, hot solution of lye, which should be used with care, as it burns the skin badly.

Oil and grease can be removed from the inside of the radiator and other parts of the cooling system by putting in a liberal supply of either kerosene or kerosene and soap and then running the engine until this cleaning compound becomes hot and has time to act on the oily deposit. The cooling system should

be drained and washed before filling again with clean water. Mud on the outside of a radiator can be removed by means of water or water and soap, and for the removal of external oil and dirt, gasoline applied with a brush or a swab will be found effective.

32. The removal of scale deposited by hard water may prove to be a difficult operation. If the chemical nature of the scale is known, a chemist can generally advise what substance will dissolve or loosen it. In many cases, however, the substance that will act on the scale will be injurious to the metal of the radiator or other parts of the cooling system. For this reason, it cannot be used, except in some cases where the action on the scale is so much more rapid than on the metal that the scale can be dissolved, or at least loosened, before appreciable injury is done to the metal.

The scale deposited by the hard water that is found throughout a considerable portion of the United States can be softened and removed with a solution of carbonate of soda, which is simply common washing soda. The proportions of the solution are about 2 pounds of soda crystals to 1 gallon of water. Before putting in the solution, the system should be thoroughly drained. The water drained out should be measured, and then an equal quantity of the solution made up and put into the cooling system so as to fill it. The solution can be left in for 8 or 10 hours and then drawn off, after which the system should be washed until the water that flows from it is clear. The scale is loosened by the carbonate of soda and washes out in the form of sludge, which looks like mud.

33. A radiator badly choked with lime scale is practically useless, although, if it is made entirely of brass and copper, the scale may sometimes be removed by the use of a dilute solution of hydrochloric acid in the proportion of about 1 part of acid to 10 parts of water. This solution should be left in the radiator long enough only to loosen the scale, after which it should be drawn off and the radiator washed out. In doing this, a good plan is to disconnect the radiator from the engine so as to confine the effects of the acid. The scale in the water-jacket space of the engine can be scraped off from the accessible portions. Scale is not likely to deposit to any great extent in radiators that have thin, flat vertical tubes, especially if there is rapid forced circulation of the cooling water by a powerful circulating pump.

There is seldom enough oil in the cooling water to cause much coating of the cooling surfaces. About the only place that oil can get in is at the circulating pump when it is excessively lubricated. In many sections of the United States, automobiles can be run for several years without appreciable deposit of mud or scale. Rainwater or other so-called soft water should be used wherever possible, and all water should be strained.

**34. Defective Pump Packing.**—If the packing of the cooling-water circulating pump becomes loose enough to cause a leak, the water system will be gradually drained. When the water level falls below that necessary to keep up circulation, the cylinders will become hot, possibly hot enough to cause trouble in the engine.

The circulating pump is usually provided with an adjustable stuffingbox gland so as to keep the packing water-tight. If any special form of packing originally used in the pump becomes so worn that it cannot possibly be kept water-tight, the pump can be very satisfactorily packed by the use of tow, provided the gland is anything like the customary form. Tow is an inferior quality of flax, such as is used in making linen goods. In order to use the tow for packing, it should be straightened out into a rather thin, long string and then twisted slightly so as to hold it in shape. The ends should be tapered down to a few fibers. To put the tow packing in place, it is wrapped around the spindle and pressed into the stuffingbox space with the end of some blunt tool, such as a screwdriver that is worn round on the corners or a hardwood stick suitably shaped. The tool used should not have sharp edges, else it will cut the fiber of the tow. Care should be taken not to scratch a bearing surface or injure a screw thread with a hard steel tool. The gland of the box is then pressed into place and drawn hard against the packing by the nuts or other devices provided for holding the gland in place. After the gland has been drawn down hard against the packing, the nuts should be slightly loosened to remove the pressure against the packing. The object in first tightening the gland up hard against the packing is to press the packing into shape, so that it will fill the packing space. The final adjustment should be such that the shaft will turn freely, but there should be no leak past the gland.

## LUBRICATION TROUBLES

**35. Lack of Cylinder Oil.**—The symptoms of lack of cylinder oil are manifested in a sudden laboring of the engine, a dry or groaning sound, and partial loss of compression, followed by probable seizing of the piston. If the piston does not seize, it the cylinder walls will at all events be scored. A groaning sound due to lack of lubrication in a cylinder practically never occurs in a single-cylinder engine, and it seldom occurs in one with only two cylinders; but in an engine with three or more cylinders, one of the cylinders may become dry and the others still have enough power to drag the dry piston against the excessive frictional resistance thus produced.

Among the causes of lack of cylinder oil are clogging of lubricator by dirt or waste, obstruction in oil pipes, leaky check-valves, leaky pump packing, broken oil pipe, oil too cold to feed, lack of oil in crank-case, etc. The remedies for trouble due



to lack of cylinder oil will become obvious on inspection. The engine should be stopped and allowed to cool, and it should be seen that the section of the crank-case corresponding to the dry piston has a liberal supply of oil before starting again. Also, a little oil should be squirted through the compression relief cocks or through the hole made by removing a spark plug, in order to insure the lubrication of the pistons without waiting for oil to reach them from the regular sources. The obstruction should be removed or the break repaired as soon as possible.

**36. Lack of Oil in Bearings.**—A slightly loose main or crankpin bearing will sometimes be cut badly as a result of a temporary stoppage of oil feed, and yet give no noticeable symptom until the bearing is so badly cut that knocking begins. If a well-fitted bronze-bushed bearing becomes dry, it is more likely to stop, or at least retard, the engine. A babbitted bearing will melt out and let the shaft settle as far as other supports or bearings will allow. The result may be a violent pounding, a bent or broken shaft, or cut bearings generally, according to the particular conditions. There is no real safeguard against lack of oil in bearings except the vigilance of the operator, combined with a system of oiling not liable to go wrong. It is not safe to depend on detecting a dry bearing by the sense of touch, because often the metal adjacent to bearings is sufficient to carry the heat away. Generally, trouble from this cause is due to neglect to supply oil or to see that the sight feeds are working properly. It may also be due to a broken pipe, cold oil, etc.

There is no excuse for neglect to clean the oil strainer or for failure to inspect the oil pipes, unions, etc. or to know when starting out how much oil is in the crank case. A badly cut bearing should be sent to a repair shop and attended to without delay; but a bearing only slightly cut may be kept in service by the addition of a small quantity of flake graphite to the oil. If possible, the shaft should be taken out and polished with emery cloth and oil, otherwise bronze from the bearing is likely to cling to it and aggravate the cutting.

**37. Improper Oil in Cylinders.**—The trouble symptoms produced by the use of oil unsuited for lubricating the piston are white or yellow smoke in the exhaust, rapid fouling of spark plugs, partial clogging of inlet and exhaust valves, and rapid accumulation of carbon on the valves in the combustion chamber and about the piston rings.

To remedy the trouble, empty out all of the unsuitable oil if possible and substitute oil known to be good. Inject kerosene freely through the compression relief cocks or spark-plug holes to loosen the carbon deposit on the piston rings, and use kerosene to free the valves if they stick. Drain the crank-case, and if possible open it and clean out any carbon that may have worked down past the piston and mingled with the oil. Change



all the spark plugs, and clean them when opportunity offers. Put in plenty of fresh oil before starting, and see that oil is supplied to the pistons so that they will not go dry before oil begins to feed from the cylinder lubricator.

**38. Too Much Oil on Pistons.**—Too much oil on the pistons is indicated by white smoke in the exhaust, and fouled spark plugs and valves, substantially as when inferior oil is used, though the symptoms are not so pronounced. An examination of the combustion chamber through the inlet valve or spark-plug hole, using a mirror and electric flashlight if necessary, will show an unnecessary amount of oil around the top of the piston. With the oil correctly regulated, it should not accumulate on the piston head in any great quantity.

Trouble from this source is remedied by drawing off part or all of the oil from the crank-case, provided it contains more than is necessary for running the engine, and reducing the oil feeds to the cylinders if necessary.

### Part 3

## CYLINDER AND PISTON DISORDERS

### EXAMINATION OF PARTS

**39. Scored and Leaky Cylinders.**—One cause of scoring of the cylinder lies in the fact that the ends of the piston pin or wristpin when loose sometimes protrude through the hole, or bearing, in the piston. Some pins have their bearing in the piston itself, while others, being tightly secured in the piston, have their bearing in the upper end of the connecting-rod. No matter which construction is employed, the ends of the pins should never come in contact with the cylinder walls. The pin must by some absolutely positive method be kept in place.

Although a loose wristpin is often the cause of a scored cylinder, yet there are three other causes, resulting from imperfections of design or of machine work, to which scoring can be traced, namely, loose core sand, imperfectly fitted piston rings, and loosening of the pins that are sometimes used to prevent the piston rings from turning in the slots in the piston.

**40.** Trouble from loose core sand in due to sharp sand that usually comes from the cored passage connecting the crank-case with the inlet or pass-over port to the combustion chamber of two-cycle engines. With cylinder castings properly pickled in dilute sulphuric acid to remove the sand, this trouble is not experienced; but with the method of cleaning castings by means of the sand blast, the cored passages are frequently neglected. Some two-cycle engines are provided with a removable plate over the inlet port for the purpose of permitting an examination to make sure that it contains no core sand to cause trouble.

If, in an engine of the two-cycle type, the scoring consists of several parallel marks on the side where the inlet port is located, it is safe to ascribe the trouble to sand. If the scoring is on the exhaust-port side, it is usually an indication of insufficient lubrication; as the hot exhaust gases pass out they burn the oil off that side of the piston and cylinder, the exhaust side of the two-cycle engine cylinder being always hotter than the inlet side. Scoring may occasionally be due to the presence in the cylinder of pieces of the porcelain insulation of spark plugs. Cylinders have been practically ruined through dropping into them the pin or nut that holds in place the spring on an inverted inlet valve.

The scoring of a cylinder may also be caused by a particle of hard carbon getting between the cylinder wall and the piston, or by a small particle of hard foreign substance being drawn in through a carbureter whose inlet is not protected by a screen. A scored cylinder naturally allows leakage past the piston, with consequent loss of power. If the groove is so large that considerable of the hot gas can escape into the crank-case, the latter will become unduly warm during the regular operation of the engine.

41. Leaky cylinders, particularly in two-cycle engines render the wristpin, crankpin, and main-shaft bearings subject to excessive wear, because the heat of the gases that pass by the rings into the crank-case tends to burn up the oil and heat the bearings. If the engine is of the two-cycle type, the leaking products of combustion not only foul the fresh charge of gas so that it is not so explosive, but also reduce the quantity of each charge.

If, in an engine in which the inlet and exhaust valves are tight and there is no leaky gasket, it is found that the compression has become materially reduced, the trouble is probably caused by leaks from distorted, scored, or imperfect cylinders, the pistons or piston rings being worn considerably or stuck in the slots of the piston. The only remedy in such cases is to remove the pistons for examination.

If the cylinder is found to be out of round or scored, it will have to be rebored or reground and new pistons and rings will have to be fitted unless a new cylinder and piston can be obtained at a lower cost. If the rings are found to be rusted or stuck in the slots, they will have to be removed, even if to do so it is necessary to break them. They may have worn to such an extent that the openings at the points of parting are such as to allow a loss of pressure, the leaking charge passing either into the tight crank-case, if the engine is two-cycle, or into the atmosphere. If such leakage is not stopped, the heat of the escaping gases will burn the oil out of the crank-case, and the bearings will soon become badly worn and perhaps ruined.

**42. Cracked Cylinders.**—The result of overheating, due to the failure of the cooling system, as well as of the freezing of the water in the water-jacket, is a cracked cylinder. The effect of a cracked cylinder is generally an immediate loss of power and still more excessive heating of the cooling water, which, in the case of a single-cylinder engine, will generally result in stopping the engine. A multiple-cylinder engine, however, may continue to run on the other cylinders for some time after one has become cracked.

An engine that has a cracked, or porous, cylinder or a loose plug in a cylinder wall will always heat the cooling water more rapidly than when there is no such defect. Some of the cooling water will generally be drawn into the cracked cylinder during the suction stroke. This water immediately vaporizes, and the steam thus formed prevents a full charge from being drawn in during the suction stroke. The spark plug is also likely to become so wet that its insulation is imperfect and a short circuit occurs. Both of these actions cause misfiring, and the dilution of the charge by the steam is liable to cause back firing into the carbureter.

A cracked automobile-engine cylinder can rarely be repaired satisfactorily in the ordinary garage or machine shop. There are a number of concerns, however, properly equipped to repair broken cylinders by brazing or welding, and in many cases such a concern can satisfactorily repair a broken cylinder at a small cost compared with the price of a new one.

**43. Cylinder-Packing Troubles.**—The joints between the cylinder head and the cylinder of automobile engines are kept tight by packings that are usually cut out of sheet asbestos about  $1/32$  inch thick. When the packing is damaged by overheating or excessive pressure, water from the jacket leaks either to the outside or into the cylinder. The latter is the more serious leak of the two, as it interferes with the running of the engine by corroding the valve seats and stems, and preventing proper lubrication of the piston and cylinder.

In most cases, the blowing out of a packing is caused by the combustion pressure opening the joint between the packing surfaces, the packing being heated and partly destroyed, and allowing water to enter the combustion chamber. A partial or complete stoppage of the cooling-water supply or the clogging of the water spaces with lime or similar deposits will also result in the overheating of the cylinder and consequent damage to the packings.

As soon as a leak of water from a faulty packing develops, preparations should be made to renew the packing at the first opportunity. If the leak is to the outside, it may not interfere with the operation of the engine, although it will cause inconvenience through having to replenish frequently the water in the cooling system. If the leak is toward the combustion chamber, the engine will generally stop in a short time.



44. Most automobile engines have the cylinder heads and cylinders in one piece; but a few engines have copper or aluminum water-jackets. There are, however, some engines with separate heads. In some cases, the cylinder heads, when separate, are made a ground fit on the cylinders, but they are commonly made tight by asbestos gaskets. Leakage through these gaskets may be detected sometimes by the sound and sometimes by putting a little oil over the suspected place and noting the resulting bubbles when the crank is turned.

In case a cylinder-head gasket leaks, it will be necessary to put in a new gasket. The head should be taken off, the old gasket removed, and the iron surfaces in contact with it carefully scraped clean. The new gasket may be of sheet asbestos, and it should be sprinkled evenly with powdered graphite to prevent it from sticking. It may be cut to size by laying it on the cylinder and tapping it lightly with a small hammer to indicate the outlines. Care should be taken not to let inwardly projecting edges interfere with the valves; and, also, if there are openings through the head for the passage of water, it should be seen to that these are not closed by the asbestos.

A good packing for the cylinder head is sheet asbestos with woven brass wire embedded in it. Packing of this kind is much stronger than ordinary sheet asbestos, and will not blow out unless the cylinder-head bolts are loose or the head is a bad fit. In replacing a cylinder head, the bolts should be tightened gradually and evenly, each being tightened a little at a time and the round being made three or four times so as to avoid localizing the stress on any one bolt.

There is, of course, but one remedy for leaky gaskets, namely, renewal. The old gasket should be carefully and completely removed, and by means of a straightedge a careful examination should be made to discover, if possible, why gasket gave way at a particular point. There may have been insufficient surface or too little holding-down pressure to keep the packing in place, the studs may have been too far apart at the point of rupture or the nuts may not have been tightened after the engine had become heated.

45. **Worn Pistons.**—The piston should be examined carefully for wear. The side on which the angular pressure of the connecting-rod is exerted should, of course, show the most wear. If the front or the rear side of the pistons shows wear at the top or the bottom, with a corresponding amount of wear on the opposite bottom or top, it is proof that the hole through the piston for the piston pin, to which is connected the upper end of the connecting-rod, is higher at the end showing wear at the top of the piston than at the end showing wear at the bottom. If this is found to be the case, and the wristpin is tightly secured in the piston, the connecting-rod bearing for the wristpin will be found to have worn badly and will be bell-



mouthed; that is, larger at the ends than at the center. The remedy for this condition is to true up the hole carefully and bush it, or to use a pin that is a trifle larger than the hole, increasing the size of hole in the upper bushing slightly. This is a repair job that should be entrusted only to a thoroughly reliable machinist having the tools and means for doing accurate work. Side wear on the piston is much more likely to show in engines having the wristpin held securely in the upper end of the connecting-rod, the ends of the pin having bearings in the piston.

**46. Worn and Broken Piston Rings.**—Piston rings become stuck in the slots of the piston from two causes, namely, from water getting into the combustion chamber, causing the rings to rust, and from the sides of the slots being slightly tapered instead of parallel. Where tapered sides are found, it is usually necessary to straighten them up in a lathe and use slightly wider rings. Piston rings should be renewed much oftener than is customary. As they become more and more open at the ends, the hot gases passing by the ends of the rings have a harmful effect on the polished cylinder surfaces, and in two-cycle engines they foul the mixture in the crank-case.

Broken piston rings, particularly in engines with ports that are opened and closed by the pistons, are a source of annoyance and frequently cause much trouble. Piston rings are frequently broken because of insufficient care in putting the piston, with the rings in place, into the cylinder, but breakage is more likely to result from getting a ring end caught in a port. To prevent this, two-cycle engine rings are usually pinned so that they cannot turn until the ends get opposite the port.

The breaking of a piston ring will cause loss of compression, which may be distinguished from leakage due to the rings being worn by the fact that the broken ring will make a distinct clicking sound at the end of every stroke. It will also be found that oil squirted on the piston when a ring is broken will not stop the leak. If the engine has more than one cylinder, it is probable that loss of compression due to lack of oil will affect all the cylinders, whereas a broken ring affects one only. If a piston ring is broken, it becomes necessary to take off the cylinder without delay and to put in a new ring.

**47.** Piston rings are sometimes held in position by small pins, one in each ring, so that the joints of adjacent rings are diametrically opposite. If for any reason these pins break, a ring may slip round until its joint is in line with that of the next ring above or below. With badly worn rings gaping wide open at their ends, this condition will cause loss of compression that may be very puzzling. It is an unusual occurrence, however, and, in order to locate the trouble, the cylinder may have to be taken off.

48. A loose piston ring, when the looseness is sidewise in the grooves, is liable to produce a very sharp clicking noise. This noise may not occur to a noticeable extent when the engine is well lubricated or running on a light load; but when the throttle is opened, the clicking may be very decided, especially if the cylinder is not amply lubricated.

No special injury is likely to occur on account of clicking piston rings, but the gradual wear of the sides of the rings and the grooves in which they fit will have a tendency to force them out against the cylinder wall harder than is necessary for satisfactory operation. If the rings are allowed to operate in this manner for a great length of time, it is possible that this wear may be so uneven that, together with the increased pressure against the cylinder wall, a ring may be broken. In breaking, a ring sometimes gives off a small piece of metal that scores the cylinder.

The remedy for worn slots and rings is to remove the rings, and if the sides of the grooves in which they fit are found to be worn, the grooves should be machined in a lathe so as to make them of uniform width. After this, new rings of the proper width should be inserted.

## TESTS FOR COMPRESSION LEAKS

49. **Hand Tests.**—For a four-cycle automobile engine with the usual mechanically operated valves of the poppet type, a hand test for compression can be made by cranking the car slowly by hand and noting the resistance to the rotation that is caused by the action of the compressed charge upon the piston. Before making the compression test in this manner, however, it should be first determined how freely the engine rotates when there is no compression. This can be done either by opening the compression relief valves of all the cylinders or by removing the spark plugs, releasing the clutch, and then cranking the engine at a comparatively slow rate by hand. An engine that is in good condition can generally be rotated slowly by the pressure of one finger of the hand on the hand crank. If the engine does not rotate as easily as this, there is too great frictional resistance to its rotation, except, of course, in possible cases of an exceedingly large engine. If this frictional resistance is very great, it will probably not be possible to make the compression test before the engine is put in proper condition with regard to its ease of rotation.

50. The following is a general outline of the method that can be employed to test the compression by cranking the engine:

Open the relief valves or remove the spark plugs of all cylinders, and then open the ignition circuit for all cylinders at the switch provided for that purpose or at each spark plug. Crank the engine slowly to determine whether or not it rotates freely and without excessive frictional resistance. If there is great

frictional resistance, the engine should be lubricated to reduce the friction. If there is no reduction of friction by complete lubrication, then the crank, cylinders, and pistons should be examined to determine their condition. Next close the relief valve of one cylinder, or insert the spark plug if it has been removed, and rotate slowly until the compression resistance begins to be felt. If the compression is good, the crank can be rocked back and forth by pulling it up well toward the dead-center position and then reducing the pull on the hand crank to allow it to be moved backwards by the action of the compressed charge on the piston. When all the parts are as nearly air-tight as they should be for proper operation of the engine, this rocking of the crank against compression can be continued for some time.

Another method is to pull the crank around until the compression resistance is felt to a considerable extent, and then to hold the crank stationary and note whether the compression resistance continues or decreases. By holding the crank in different positions, corresponding to a greater or a smaller degree of compression, the tightness of the piston rings in the cylinder can be tested for different positions of the piston. This, of course, can be done only when the compression space is tightly closed at all other places; that is, when there are no leaks except possibly that at the piston.

51. If the compression is poor, it may be due to a leak at any of the following parts: The exhaust valve, the inlet valve, the spark plug, a relief valve that is partly open or loose, the piston, or the joint between the cylinder or cylinder head when the head is a separate part from the cylinder barrel. It may also be due to a leaky plug that closes an opening between the bore of the cylinder and the water-jacket space, porous metal in the cylinder wall, a cracked cylinder, or a cracked piston head.

52. To test for leaks around or in spark plugs, put cylinder oil or kerosene around the spark plug, crank the engine, and note whether bubbles appear in the oil around the spark plug. The appearance of bubbles in this place indicates leakage around the spark plug. A spark plug may leak between its insulation and the metal parts. Kerosene should be used in testing for such a leak. The relief valve and plugs over valves can be tested in the same manner as the spark plug.

53. A test for leaky valves may begin at the exhaust valves. In making this test, twist the valve around so that it has a rotary, or grinding, motion on its seat. By turning the crankshaft to the position in which the valve cam just begins to lift the valve from its seat, the lifting pressure of the push rod makes it possible to twist the valve around more easily. Twisting the valve can sometimes be done with the fingers, but generally a pair of gas-pipe pliers or some similar tool is required. Twisting the valve around on its seat will generally



remove foreign matter, such as a particle of carbon, from between the valve and its seat. Carbon in this location of course causes leakage at the valve. Note whether there is a small space about the thickness of a visiting or business card between the end of the valve stem and its lifter. There should be such a space.

If necessary, remove the exhaust pipe or manifold and hold a lighted candle or match at the exhaust opening of the cylinder under test. If there is much leakage past the exhaust valve, the flame will be blown outwards by the current of escaping air or gas. It is best to cut off the supply of gasoline while making this test, so that there can be no ignition.

If the exhaust valve opens downwards from its seat, as in some engines, cylinder oil may be put around the valve just above the point where it bears on its seat. Leakage will then be indicated by bubbles or by the oil being blown off. A fine powder, such as talcum powder, can sometimes be used instead of oil. To test for a cracked valve, put the oil or the powder over the entire valve and look for bubbles or blowing off of the oil or powder while the engine is in compression.

Next, put a blank gasket over the exhaust opening so as to prevent any air or gas from passing out of it. This gasket may be clamped between the cylinder outlet and the exhaust pipe. Put oil around the valve stem where it emerges from its guide, crank the engine against compression, and note whether bubbles are formed in the oil. A heavy oil such as that used in some steam-engine cylinders will be found suitable for this test. If a piece of sheet rubber is used for the blank gasket and is held in place by an open ring of some thick material, the rubber will be bulged out by the pressure of air escaping past the exhaust valve, provided the valve stem is not very loose in its guide. If the stem is loose in its guide, a liberal supply of heavy oil or thin grease may prevent leakage past the stem during this test.

To test further for a crack in the valve, the valve should be removed. If the valve is slightly raised around the edge, immerse it partly in gasoline with the raised edge upwards. The gasoline will penetrate even a very small crack and appear on the upper side of the valve. It may sometimes be more convenient to pour gasoline on the depressed upper surface of the valve and then note whether it appears on the under surface.

The inlet valve can be tested in the same manner as the exhaust valve.

54. To test for a leaky cylinder, remove the pipe through which the hot cooling water flows from the cylinder jacket and see that the jacket is filled to the top of the outlet. Crank the engine against compression, and look for bubbles rising through the jacket water. Such bubbles indicate a leak from the cylinder bore into the jacket space. It may be possible



that the bubbles come from around a plug in the cylinder wall that was inserted to close a blowhole; otherwise, bubbles indicate a cracked porous cylinder wall in an engine whose cylinder head is integral with the barrel. If the cylinder head is separate from the barrel, the leak may be through the joint between these two parts.

55. To test for leakage past the piston in an engine of the vertical type with the cylinders above the crank-shaft, pour enough kerosene into the cylinder to cover the top of the piston completely. Crank the engine, hold it on compression, and note whether or not any of the kerosene drips down past the piston. The crank-case will have to be open, of course, for this test. Gasoline should not be used in the cylinder, however, because it will penetrate a joint between the piston rings and cylinder wall that is sufficiently air-tight for all practical purposes. Moreover, if gasoline is used, it will cut the oil so thoroughly from the rubbing surfaces that there is danger of their abrading and scoring when the engine is run. It may be possible to observe whether the kerosene leaks out between the piston and cylinder wall or through a crack in the piston head. In the latter case, the kerosene will come down through the inside of the piston.

56. To determine whether or not the piston itself is cracked, it should be removed from the engine and partly immersed in gasoline, keeping the open end on top. If it is cracked, the gasoline will penetrate to the inside. Another method is to pour some gasoline into the piston while it is placed with its open end facing upwards and then note whether or not any gasoline penetrates through a crack to the outside.

57. **Running Test for Cylinder Leaks.**—Instead of testing by hand cranking, it is sometimes more convenient to examine cylinders for all leaks except valve leaks while the engine is running.

For leaks past the piston or through a crack in the piston head, open the crank-case, jack up the rear wheels so that they are free to rotate, and start the engine. Put the friction clutch in engagement and apply the brake so as to make the engine pull up to about its full capacity. Note whether smoke appears in the crank-case. The presence of smoke in this place is due to a leak past the piston or through a crack in the piston head. If the mixture is made overrich, more smoke will appear in the case of a leak than with a normal or lean mixture. An excess of lubricating oil may produce more smoke in the crank-case than will less oil, especially if the oil is very thin and of a poor quality, for cylinder lubrication. There is always a possibility, however, that an excess of lubricating oil will stop a leak past the piston and thus prevent the escape of smoke in the crank-case.

58. To test for a cracked or porous cylinder, a loose plug in the cylinder wall, or leaks between the head and the barrel of the cylinder, provided these parts are separate members of the engine, proceed as follows: Remove the cooling-water pipe from the top of the cylinder, disconnect the water-circulating pump so that it will not run, fill the water-jacket until the water is level with the top of the outlet, and jack up the rear wheels of the car. Start the engine, immediately put the clutch into engagement, and apply the brakes so as to put nearly the full load on the engine. Notice whether bubbles of gas rise through the cooling water. If the vibration of the engine agitates the water so that it is difficult or impossible to determine whether bubbles are rising through it, place a piece of window glass over the opening so as to be in contact with the surface of the water and thus keep it quiet.

It is not generally possible to determine where the gas escapes from the cylinder while making this test unless there is an unusually large opening in the top of the jacket for the outflow of the cooling water. This test must be made rather quickly, because the heating of the engine will soon cause bubbles of air to appear on the outside of the cylinder walls. These bubbles finally detach themselves and rise to the top of the water. Continued heating of the cylinder may be sufficient to produce steam in the cooling water, and this steam will rise in the form of bubbles to the surface of the water. It sometimes happens that a cracked cylinder or a leaky plug does not leak while the engine is cold, but begins to leak freely after it is well warmed up. The engine should therefore be run along enough to heat it well without allowing it to become so hot as to generate steam. In some cases it may be possible, without great trouble, to arrange for a slow circulation of water through the cooling jacket.

59. **Hydrostatic Test for Cylinder Leaks.**—A single test for all leaks from the cylinder of an engine can be made by filling the cylinder with liquid under pressure. Kerosene is doubtless the best liquid for this purpose, although water answers fairly well. Water does not pass between oily surfaces so readily as does kerosene and for this reason does not show minute leaks so well, except, of course, where there is no oil. A small force pump capable of giving a pressure up to 350 pounds per square inch is required.

The hydrostatic test can be made in the following manner: Disconnect the mixture inlet pipe, the exhaust pipe, and the cooling-water inlet pipe, and stop them up with a cork or a plug of some kind. Remove the spark plug, and attach the force pump to the cylinder by means of a pipe connected to the opening left by the removal of the spark plug. Pump the kerosene or the water into the cylinder and look for leaks. The leaks will be indicated by the flow of the liquid from them.

If the crank-shaft is left free to rotate as the pressure is applied to one cylinder only, the piston will naturally move out to its position farthest from the cylinder head. This position is the one in which the gas pressure applied to the piston is lowest in the regular operation of the engine, and also the one in which leaks at the piston are of least importance. A pressure of 60 pounds per square inch is high enough for testing in this position.

The test for the piston in the position farthest from the crank-shaft can be made by placing the crank-shaft in the head-end dead-center position for the cylinder under test and locking it in this position. This can generally be done by throwing the clutch into engagement and setting the brakes, provided the crank-shaft is placed accurately in the head-end dead-center position. A pressure of about 350 pounds per square inch may be applied while the crank-shaft is in this position. The piston can be put in different positions and the flywheel locked to hold it while pressure is applied with an intensity corresponding to that which occurs during the operation of the engine.

**60. Compressed-Air Test for Cylinder Leaks.**—If compressed air is available, it may be used for testing in a manner similar to that described in the preceding article. It should be born in mind, however, that compressed air is very expandible and is therefore liable to produce violent motion of the engine if the parts are not locked securely.

If the cylinder is removed from the car and immersed in water during the application of compressed air, the leaks will be plainly indicated by the bubbles coming from them. The piston must be held in the cylinder by some means after it is removed from the car, as, for instance, by a block of wood held against the piston by bolts and clamps suitably arranged. A metal clamp should not be used against the edge of the piston.

## Part 4

### VALVE-GEAR DERANGEMENTS

#### VALVE TROUBLES

**61. Leaky Inlet and Exhaust Valves.**—Trouble from loss of compression in the combustion chamber, when the spark plug is tight and there is plenty of oil on the piston, is generally due to leaky valves. In order to determine whether the leak is in the valves or in the piston rings, a moderate quantity of oil may be squirted through the compression relief cocks and the crank turned two or three times, so as to check temporarily whatever leakage there may be around the piston. If the compressed charge still escapes, the inlet valve, if located over the exhaust valve, may be taken out and examined. The leak, however, is more likely to be in the exhaust valve, because



the seat of the latter is subjected to the eroding action of the highly heated exhaust gases that pass over it.

To take out the exhaust valve, turn the engine over by hand, with the switch off and the compression relief cocks open with two pieces of wood or brass cut to the proper length to fit between the spring collar and the upper end (or lower end, if this is more convenient) of the push-rod guide, and turn the engine again until the push rod is down as far as it will go. Push the exhaust valve down; the key may now be slipped out. If the props have been made accurately to length, the valve may be slipped up and out, leaving the spring and the collar in place. Inspection should show the valve seat to be dull—not glossy—and of uniform appearance all the way around. If the seat of either valve is pitted or rough, or if it is worn bright on one side, showing that it has been seating only on that side, it should be reground.

62. If blocks cannot be placed on the end of the valve-lifter guide in the manner just described, it may be necessary to use a tool, called a valve lifter, made especially for the purpose of lifting valve springs. There are several styles of valve lifter on the market.

One form of tool for compressing a valve spring so that the key, or pin, can be removed from the stem is shown in Fig. 3. This tool has a hook-shaped member *a* to which is attached

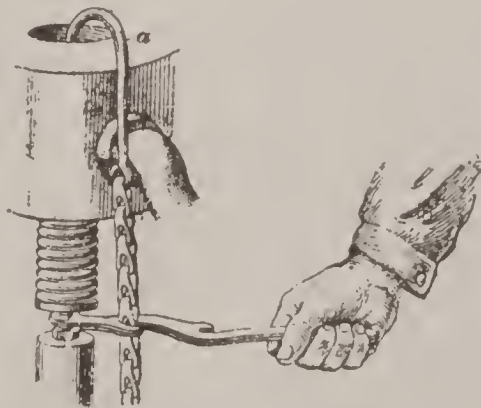


Fig. 3

a piece of chain for supporting the lever that is used to compress the valve spring. In engines designed with valve covers that are depressed in the middle, the hook can be placed in the depression of the valve cap over the valve, and in other cases it can be placed against the top of the valve itself when the valve cap is removed.

A similar device can be made out of a strong string or a piece of wire and a lever with a suitable end for engaging the spring, for instance, a long screwdriver. The string or the wire is formed into a loop, and one end of it is fastened somewhere near the top, or head, of the valve. The lever is passed through



the other end of the loop, which acts as the fulcrum for the lever. Pressing down on the outer end of the lever will force the valve spring upwards.

63. Another tool for compressing the valve spring in order to remove the key from the valve stem is shown in Fig. 4. The two pronged ends *a* and *b* are inserted between the thrust washer against which the valve spring bears and the guide of the valve lifter rod or some corresponding part. Before inserting the two prongs, however, they are brought together so as to allow easy insertion. The prongs are then separated by turning the wing nut *c*. Screwing up this nut draws the screw *d* back

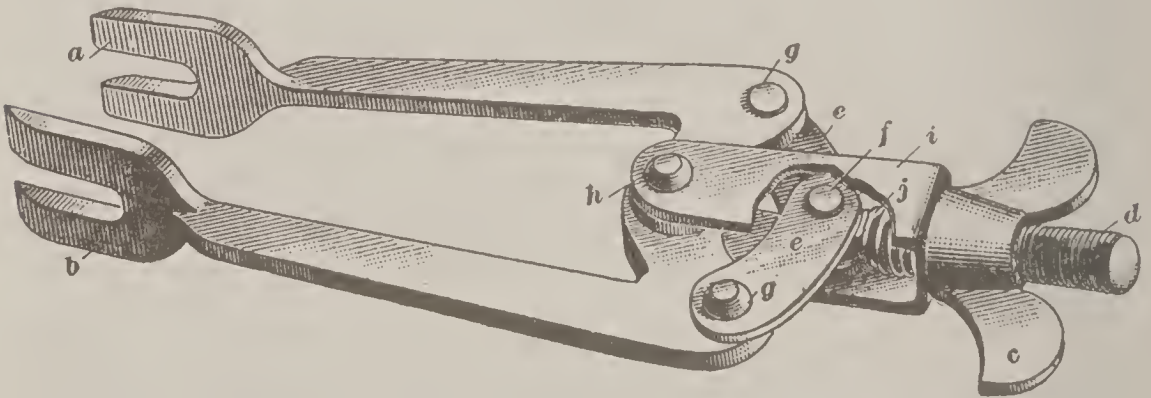


Fig. 4

in the direction away from the prongs. The inner end of this screw is attached to togglejoint links *e* by means of a pin *f*. The outer ends of the links are connected by means of pins *g* to the arms that carry the prongs. The arms are pinned together by the pin *h*, which also pins them to the U-shaped piece *i*, against which the nut *c* bears. The expansion spring *j* forces the threaded piece *d* in toward the togglejoint when the wing nut is unscrewed, thus bringing the prongs toward each other.

64. A leaky exhaust valve is generally due to warping or pitting of the valve; the valve seat rarely pits. The pitting is especially likely to occur if the engine is run with the ignition later than it should be. When running in this manner, the hot gasses or even the burning gases raise the temperature of the valve to a high degree. This high temperature and probably the erosive action of the hot gas flowing past the valve cause the pitting. If a pit extends all the way across the bearing surface of the valve, or if two or more pits connect with each other so as to reach across the bearing surface, which is usually the case, the valve will, of course, leak. An extremely small pit in a valve will cause enough leakage to cut down the power developed in the corresponding cylinder to a very small proportion of what it is under proper operating conditions.

The remedy for a leaky valve is to regrind it properly.

65. A bent valve stem may cause the valve to leak by preventing it from seating properly. Such a stem may also bind in its guide, so that the valve remains quite wide open at times, but closes more or less perfectly at other times.

A valve stem that is too long will also cause a valve to leak. After regrinding a valve and drawing out the stem, the latter may be so long as to strike its push rod or lifter so that the valve cannot rest on its seat. A stem that is just long enough to allow the valve to seat itself and give good compression when the engine is cold maybe expanded enough by the heat when the engine is running to prevent the valve from settling on its seat and thus cause leakage that materially cuts down the power of the engine.

A dirt-coated valve stem may cause the valve to behave in much the same manner as a bent stem, except that there is not likely to be any leakage when the valve is resting on its seat. It should always be remembered that a particle of carbon or other foreign matter may cause a valve to leak temporarily. A dirt-coated valve stem can sometimes be cleaned by putting kerosene on it while the engine is hot. If the engine is cold, gasoline will answer as well or perhaps better. The gasoline is useless for this purpose when the engine is hot, because under such conditions it immediately vaporizes and passes off. In some cases, however, the coating is of carbon so hard that neither the kerosene nor the gasoline will remove it. Probably the only remedy in such a case is to scrape off the carbon with a suitable tool.

66. **Excessive Lift of Automatic Inlet Valve.**—The lift of of an automatic inlet valve should be proportionate to the spring tension and to the weight of the valve, so that the spring will be able to overcome the inertia of the valve and close the valve before the piston has started so far on its compression stroke as to expel any of the mixture through the open valve.

The symptoms of too great a valve lift are loss of power and blowing back at high speeds. A valve 2 inches in outer diameter should not ordinarily lift more than  $\frac{1}{8}$  inch, and a lift of  $\frac{3}{16}$  inch would be excessive for almost any valve found on high-speed engines. An excessive lift, like a weak spring, is likely to result in breakage of the valve stems and keys through unnecessary hammering of the valve when opening and closing.

67. **Broken Inlet-Valve Stem or Key.**—Trouble from a broken inlet-valve stem or key is more likely to occur with automatic valves than with valves mechanically operated. The result, if the valve opens downwards, is to let it stay open all the time, causing that cylinder to cease work, while the sparks from the plug ignite the mixture in the intake pipe

and cause explosions there and in the carbureter. If the valve, whether automatic or mechanically operated, opens upwards, it will clatter on its seat and permit much of the mixture to be expelled during the first part of the compression stroke.

**68. Broken Exhaust-Valve Stem or Key.**—As there is nothing to prevent the valve from being sucked wide open on the suction stroke, an accident of this kind will generally cause that cylinder to go out of action entirely. The clattering, if the engine continues to run by virtue of other cylinders, is likely to be marked.

### VALVE-SPRING DEFECTS

**69. Weak or Broken Inlet-Valve Spring.**—Sometimes the inlet valve spring, especially if the valve is of the automatic variety, will weaken from becoming overheated. In time, a spring loaded too near its elastic limit will break from the jarring to which it is subjected. The symptoms in either case are loss of power at high speeds—although the power may still be ample at low speeds—and clattering of the valve and blowing back in the intake pipe at high speeds. The latter trouble may easily be detected in a single- or double-cylinder engine by holding the fingers close to the air intake, when the backward puffing will be very perceptible. If the engine has four cylinders, it may be possible for the inlet-valve springs to be slightly weak without the mixture blowing back into the intake, owing to the fact that one or another cylinder is aspirating all the time and the air expelled from one cylinder is drawn into the next. One way to get around this difficulty is to block open the exhaust valves of two cylinders—the first and fourth or the second and third—while the others are tested. It will probably be simpler, however, to experiment with the valve-spring tension. If the valve spring is weak, and if it is temporarily increased in stiffness by putting washers under it to compress it, a marked increase in the power of the engine at high speeds will be noticeable. Care must be taken not to use so many washers that the valve cannot open. The proper remedy, however, is to put in a new spring; or, if this cannot be done, to stretch the old spring. For a valve lift of  $\frac{1}{8}$  inch, and for average engine speeds, the tension should not be less than 1 pound per ounce weight of the valve, washer, and key. The engine will work better if the springs are a little too stiff than if they are not stiff enough. There will also be less danger of breakage of the valve stems and keys.

**70. Weak or Broken Exhaust-Valve Spring.**—Owing to the heat to which it is subjected, the exhaust-valve spring is more likely to weaken than the inlet-valve spring. The symptoms are loss of power, owing to the valve lingering open at the



end of the exhaust stroke, and clattering when the valve closes.

**71. Unequal Tension of Automatic Inlet-Valve Springs.**—The effect of unequal tension in the springs of automatic inlet valves is to permit one cylinder to take more gas than another. Consequently, at slow speeds the cylinder whose valve spring is weak and will get the larger charge, and at high speeds part of the charge will be blown back through the valve whose spring is weak, so that the other cylinders will get stronger impulses. A quick way to test the equality of valve-spring tension without taking out the valves is to run the engine slowly with the throttle almost closed. This will cause the cylinders whose springs are stiffer to receive scarcely any gas, and the cylinders whose valve springs are weak will do most of the work. It is possible, however, to go to excess in a test of this sort, because, when an engine is running light with the minimum quantity of gas, one cylinder is almost sure to get more gas than another, provided the inlet valves are automatic, even with the most careful equalizing of the springs. If the tension of the valve springs is under suspicion, the valves should be taken out and the springs tested by pressing the valve stems together, as illustrated in Fig. 5. If the springs are unequal in strength, the weaker one will be compressed more than the other.

**72. Temporary Repair of a Broken Valve Spring.**—A broken valve spring of the coiled-wire type can sometimes be temporarily repaired by placing a metal washer, such as is

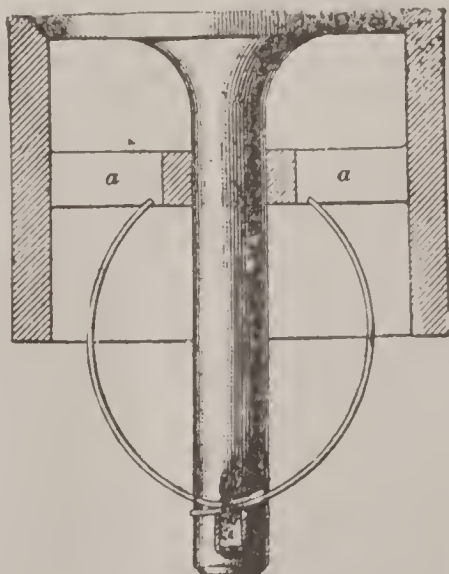


Fig. 6

used on bolts, between the two ends of the broken spring. This washer, of course, may be of some other material than metal, as, for instance, hard fibre or wood. A better repair can sometimes be made by using a rather thin metal washer,



slitting it radially inwards from the edges and then bending each second strip thus cut upwards and the other strips downwards, so that a sort of double cup-shaped piece is formed that will hold the ends of the spring in place better, if of the proper diameter, than will a plain washer. Sometimes two curved pieces of clock spring or corset steel can be used effectively for temporarily replacing a broken spring of an automatic inlet valve. As shown in Fig. 6, the two pieces of steel are tied to the key that passes through the end of the stem. For tying, soft wire or even string may be used, as there is nothing to burn the string, unless there is a back firing. The upper end of each piece of steel must be notched to fit over the arms *a* of the valve-stem guide. Such a device is advisable only in an emergency, however.

### *Driving a car with a useless cylinder.*

73. If the inlet valve of one of the cylinders of a multi-cylinder engine becomes inoperative, that cylinder, of course, is useless for driving the car. The car, however, can be run on the remaining cylinders, but in order to do so, it may be necessary to close the inlet port in some manner. This can generally be done most conveniently at the inlet valve, provided it is not broken, by holding the valve firmly and permanently against its seat.

If the valve is mechanically operated, the means of lifting it must first be removed, provided the stem is still intact. In some engines, the push rod is the easiest to remove, and, of course, after this is done the valve will not be mechanically lifted. In case this rod cannot be removed, it may be necessary to cut off the valve stem. The valve can then be held in place by inserting a block of wood between it and the cover, or cap, that closes the opening through which the valve is inserted and removed. The block of wood should be thick enough to press hard against the valve before the cap has been drawn down tight into its ordinary position for closing the opening. Although there is really no need of doing anything with the exhaust valve, yet it may be advisable to block this valve also in order to prevent the drawing of dirt and scale into the cylinder from the exhaust passage. If the exhaust valve is blocked down, the means of lifting it will, of course, have to be removed.

If the inlet valve is automatic and is located opposite the exhaust valve, both of them can be held permanently closed by placing a block between them and tightening down the cap that holds the inlet valve in place. The means of lifting the exhaust valve must of course be removed.

If the exhaust valve is the one that is broken, it is generally advisable to block down the inlet valve, and, if convenient, the exhaust valve also. In case a valve is broken so badly that it cannot be used for closing the port permanently, a block of wood can be shaped so as to fit into one or both ports, as

the case may be, and then fastened in place in the manner already described.

The closing of the inlet port prevents the forcing of burned gases from the disabled cylinder into the inlet pipe and carbureter, and thus permits the remaining cylinders to act satisfactorily. When a disabled cylinder is thus cut off from communication with the inlet pipe, the remaining cylinders will operate in the usual manner and the disabled cylinder will require very little power to drag it. It may be advisable in some cases to remove the spark plug, especially if the exhaust valve is not blocked down. The removal of the spark plug will prevent to some extent the drawing of exhaust gases into the disabled cylinder.

## Part 5

### MISCELLANEOUS TROUBLES

#### MUFFLER AND EXHAUST-PIPE TROUBLES

74. The habitual feeding of an excess of lubricating oil to the engine or the use of an overrich mixture will gradually clog the muffler with a mixture of carbon and half-burned oil, or loose carbon, which will reduce the power of the engine by creating a back pressure that is above the normal.

The symptoms produced are abnormal heating of the exhaust pipe as well as loss of power and inability to speed up the engine when the mixture, compression, valve timing, and ignition are known to be good. If the exhaust pipe can be disconnected and the engine gives its full power at once, it is an infallible indication that either the exhaust pipe or the muffler, or both, are choked.

The obvious remedy for a choked muffler is to clear it. In some cases, when the deposit consists of fairly loose carbon, it may be knocked loose by striking light, sharp, blows on the muffler shell with a stick of wood. The exhaust will then blow most of the loose carbon from the muffler. If half-burned oil is present, the carbon deposit will be very tenacious. The muffler must then be taken apart for cleaning. The carbon deposit can be softened by a liberal application of kerosene and then removed by scraping.

75. A very hot exhaust pipe may be due to a clogged muffler or to the ignition being too late in one or all of the cylinders. If the ignition is not synchronous, then it should be brought into synchronism, so that there will be no reason for late ignition in any of the cylinders.

#### FUEL-SUPPLY DERANGEMENTS

76. **Symptoms of Fuel Exhaustion.**—When the fuel supply in the fuel tank becomes low, the engine will uniformly, but

quite rapidly, lose power and stop. The length of time required for this to occur depends of course on how much power the engine is called on to develop at the time. If the car is running along a smooth, level road it may take nearly a minute to exhaust the fuel from the carbureter, but if the engine is climbing a hill, the power may be completely lost in a few seconds after the fuel tank becomes dry.

In some forms of fuel tank, especially in a gravity tank with a nearly level bottom, the behavior of the engine may be somewhat erratic if the car is running around sharp curves or on the side of a road whose surface is considerably crowned. While running near the center of a crowned road, only enough fuel may reach the carbureter to keep the engine developing a part of its power. When the car is run to the side of the road, which brings the gasoline over the outlet of the fuel tank, or when it turns a curve so as to produce the same effect on the gasoline, the carbureter will receive a full supply of gasoline for a while and the engine will develop full power. When a curve is turned in the opposite direction, however, or when the car is run back to either the level part of the roadbed or the other side of the crowned surface, it may lose power rapidly and then stop.

Many modern gasoline tanks are fitted with a small compartment in which from 1 to 3 gallons of gasoline is kept in reserve. Communication between the main and reserve compartment is ordinarily closed. However, on the fuel in the main compartment giving out, thereby giving warning of the near exhaustion of the gasoline supply, the reserve compartment can be readily brought into action.

**77. Effect of a Clogged Vent Hole.**—If the vent in a gravity fuel tank is clogged and the tank otherwise tightly closed, the engine may lose power very gradually and finally stop. The car generally stops when demand for more power is made upon the engine, as when starting up a hill. The length of time required to bring the engine to a stop depends on the amount of air space above the gasoline in the tank. If the tank is nearly full of gasoline, it will not take many minutes for the effect of the partial vacuum in the tank to make itself evident by the decreasing power of the engine. On the other hand, if the tank is nearly empty, the car may run for an hour or so without any very great decrease in the power of the engine.

If the vent is only partly closed, or if the tank is otherwise not completely sealed, the partial vacuum in the tank can be reduced by permitting the car to stand for a short time. It may then be run again with entire satisfaction until the partial vacuum becomes great enough to prevent a sufficiently rapid flow of the gasoline from the fuel tank to the carbureter.

**78. Effect of Water in the Gasoline.**—If, when filling the



fuel tank, the fuel is always poured through a chamois-skin strainer, troubles from water in the gasoline will rarely be encountered. However, should water get into the fuel tank, either through carelessness in washing the car or through failure to strain the fuel supply, it will almost immediately stop the engine when it reaches the carbureter and is drawn out through the spray nozzle. If only a few drops of water are drawn through the spray nozzle at a time, the engine may not be stopped, because the momentum of the moving parts may be sufficient to keep it running. Its failure to develop power while receiving water from the carbureter, however, is very evident. If considerable water gets into the carbureter, so that only water can be drawn from the spray nozzle for some time, then the engine will, of course, stop.

The bottoms of some fuel tanks are formed so that the water in the gasoline will lie in a portion lower than the outlet to the carbureter. But when the car swings around a curve, or possibly when it is climbing or descending a hill or is running on the side of a crowned roadway, some of the water may flow down to the carbureter. After the trouble caused by the portion of the water that flows to the carbureter in this manner has been overcome, it may occur again under similar conditions of movement of the car. This fault is probably one of the most puzzling and troublesome to detect and overcome, especially if there is no way of draining the water from the fuel tank, as is usually the case.

**79. Temporary Repair of Broken Gasoline Pipe.**—If the gasoline pipe that conveys the fuel from the tank to the carbureter should break while on the road, a temporary repair may be made by slipping a piece of rubber hose over the broken ends. If no hose is at hand, the break may be repaired by wrapping ordinary cotton tape, such as is used by dressmakers, around it, and saturating the tape liberally with shellac varnish. The varnish should be put on while wrapping the tap. If the pipe is not completely broken in two, a liberal supply of cake soap wrapped over with tape will generally stop the leak for a time. If there is only a slight crack in the gasoline pipe, a piece of cotton wrapping cord will also generally be effective. This cord should be either saturated with shellac varnish while it is being put on or coated with soap before it is put on. Friction tape coated with adhesive rubber compound should not be used in places where gasoline can come in contact with it, as the gasoline will quickly dissolve the rubber compound.

## TROUBLES FROM LOOSE OR BROKEN PARTS

**80. Broken or Missing Part Between Engine and Driving Wheels.**—If the engine runs but will not drive the car it is evidently because some portion of the power transmission system is either broken or lost. A systematic investigation will usually



disclose the trouble. A key or pin of some portion of the transmission machinery may be lost. In some designs, this is a frequent occurrence in the universal joints that connect either the engine and change-speed gears or the change-speed gears and the rear axle.

**81. Loose Flywheels.**—A flywheel with a key that does not completely fill the keyway will generally give evidence of its looseness while the engine is pulling hard, especially if running at rather slow speed, by a heavy knocking or pounding sound. If the flywheel is very loose on the shaft and has considerable motion, its looseness can of course be readily detected; but if the flywheel fits fairly tight upon its shaft and also has very little rotative motion on account of the loose key, the trouble is not so easy to locate. In order to determine whether the flywheel is loose, lock the crank-shaft of the engine so that it cannot move at all and then pull back and forth on the flywheel to see whether there is any rotative motion. It may be even necessary to remove the flywheel and test the fit of the key. If the key is loose, of course a new one that fits properly should be substituted.

**82. Loose Bearings.**—If a connecting-rod or crank-shaft bearing is very loose, it will invariably give rise to knocking or pounding. In some cases this looseness is sidewise (in a direction parallel to the axis of the journal). Side looseness will sometimes cause sharp knocking, although it may occasionally be rather heavy and dull in spite of the fact that the cylindrical parts of the journal and the bearing fit as snugly together as they should for proper operation. A ball bearing that has become worn more than is allowable in good practice will generally pound or knock, but the sound is ordinarily not so sharp as in the case of plain bearings.

If a bearing is very loose, it can of course be readily detected by taking hold of the parts and moving them back and forth or shaking them. However, when not great, it may not be easy to locate looseness. In the case of a connecting-rod, looseness can generally be located by holding the finger so as to press on both the connecting-rod and crank-shaft and then rocking the crank-shaft back and forth very slightly.

A slightly loose bearing on the crank-shaft can be easily detected by placing a block of wood or iron so that the crank when rotated will strike against it and thus prevent further rotation. By holding the finger on the crank-shaft and bearing and gently rocking the crank-shaft so as to make it throw strike the block gently, the looseness will generally be apparent by motion between the journal and the box of the bearing.

**83. Loose Fastening Devices.**—A loose bolt or other similar device used to fasten the engine to the frame of the car or even to fasten parts of the car frame together will some-

times cause a loud knocking noise that may very easily be mistaken for a loose bearing in the engine or other parts of the car. The car should therefore be frequently examined for such loose parts.

### CHAIN TROUBLES

84. **Broken Transmission Chain.**—If a driving chain breaks while on the road, a repair that will last until some place is reached where a permanent repair can be made can sometimes be effected with a piece of wire. Whether or not wire can be used, however, depends very much on the form of the chain and the nature of the break. Ordinarily, the method of using a wire is to wind it into the chain in place of the broken link, so that several strands of the wire occupy a position practically the same as that which was occupied by the broken link. For this use, as well as for other purposes, it is advisable to carry in the repair kit of an automobile a small coil of strong steel wire that is moderately soft (not so hard as spring wire). A wire about as large as that used in a moderate-sized hat pin is the most suitable for general use.

85. **Adjusting of Transmission Chains.**—If two chains are used, as is the case with side-chain drives in which each traction road wheel is driven by its own chain, it is very essential that the rear axle be adjusted so as to be parallel with the differential shaft that carries the driving sprockets for the transmission chains. This adjustment is made by means of the nuts and threads on the radius rods, one of which connects one end of the rear axle to the corresponding end of the bearing that supports the differential shaft. The test of this adjustment can be made by cutting a stick so that it will just fit between the two sprocket wheels on which one of the chains runs. The ends of the stick may rest against the bottom of the space between the pair of adjacent teeth on each sprocket wheel. Both ends of the rear axle should be adjusted so that the stick, when used in this manner, will indicate the same distance between the sprocket wheels. It is advisable to repeat the test for different positions of the road wheels and the differential shaft in order to determine any inaccuracy in the form of the sprocket wheels. The chains should not be drawn tight, but should be left loose enough to be moved an inch or two sidewise in the center of the stretch. If one chain is worn more than the other, it will be impossible to adjust them to equal tightness and still keep the rear axle parallel with the differential shaft. However, it is better to keep the axle and shaft parallel than to throw them out of parallel in order to give the two chains equal tension.

86. **Driving a Car With a Broken Side Chain.**—If, while on the road, one of the side chains of a car is broken and cannot be repaired, the car can still be driven, provided the roads are good and have no very steep hills. To drive a car

with only one chain, the sprocket wheel on the end of the differential shaft whose chain is gone must be locked so that it cannot rotate. This may be done by using a wooden clamp or some other suitable device. Under such conditions, when power is applied by the engine, the road wheel whose chain is still intact will be driven at twice the speed, relative to the rotation of the engine, that it would ordinarily be driven. It is therefore desirable to put the change-speed gears in one of the slower speeds. When driving in this manner, the differential gears are put into active service, and for this reason it is important that they be thoroughly lubricated. The actual strain on the differential gears is not greater than when the car is operating in the usual manner, but the tendency to wear is very much greater on account of the rapid rotation of these gears on their supports, exclusive of the gear that is fastened to the shaft carrying the sprocket wheel that is locked so as to prevent its rotation.

### LOCATING SOURCE OF UNDUE FRICTION

87. Frequently, on account of undue friction in some of the bearings or other parts, excessive power may be required to drive the car. This excessive demand for power may very easily be mistaken for failure of the engine to develop full power. On the other hand, the fault may be due to excessive frictional resistance in the engine itself. Cranking the engine will of course show at once whether it turns as freely as it should. If the engine turns freely, it can then be readily determined whether or not the transmission is offering too great resistance to the engine. In order to make this test, jack up both rear road wheels, put the transmission gears into mesh so as to drive the car on any speed that may be selected, let the friction clutch into engagement, and crank the engine as before. The power required to rotate the engine should not be appreciably greater than when the friction clutch is disengaged. It is advisable to test in this manner for each setting of the change-speed gears. If excessive frictional resistance is found to be in the transmission system, then it can be determined whether the resistance is in the part between the engine and change-gear case by setting the change-speed gears in neutral position and cranking the engine. If the engine turns harder than usual, the trouble is on the engine side of the change-speed gears. The test of the remainder of the transmission system can be made by rotating first one road wheel and then the other, to determine whether the fault is in the wheel and axle or in the driving part next to it. If both wheels rotate freely, one can be lowered so as to rest upon the road or floor and the other rotated. By this method, the remaining parts between the wheels and change-speed gears will have to move, and undue frictional resistance to their motion will be apparent.



## TROUBLES AND REMEDIES

## EXAMINATION QUESTIONS

- (1) What is the principal cause of misfiring?
- (2) In what way will leakage of compression affect the explosion of the charge in an automobile engine?
- (3) How will a weak battery affect the running of an engine?
- (4) How will improper valve timing affect the power of an engine?
- (5) In a car fitted with a planetary transmission, how may looseness of the main bearings of the engine be readily detected?
- (6) What will be the result of lack of parallelism between the wristpin and the crankpin of an engine?
- (7) What is meant by preignition?
- (8) Generally speaking, what are the causes of carbon deposits in the cylinders of an engine?
- (9) In what way does lack of water in a radiator manifest itself?
- (10) In what way can oil and grease be removed from the inside of a cooling system?
- (11) How does lack of oil in automobile-engine cylinders manifest itself?
- (12) What are the symptoms indicating too much oil on the pistons?
- (13) What are the two principal causes of cracked cylinders in water-cooled engines?
- (14) In examining a piston, where should the most wear be looked for?
- (15) What are the usual causes of poor compression?
- (16) What causes exhaust valves to leak?
- (17) What effect will a bent valve stem have on the action of a valve?
- (18) With an automatic inlet valve, what are the symptoms of an excessive lift?
- (19) What causes an exhaust pipe to become excessively hot?
- (20) How is the operation of an engine affected by water in the carbureter?





## CHAPTER IX

### THE NEW STANDARD U. S. ARMY TRUCK

The standardized Class B military truck has been officially accepted by the War Department. The design did not really start till August 1 and the two sample trucks were on the road October 7, complete in every detail. While some petty changes are to be expected, since no new machine ever gets to production without some such alterations, the preliminary tests have shown that the truck will do all expected of it.

It is a fine truck for the work. It is not a commercial 3-ton truck, but it is an excellent 5-tonner, and its engine, axles and transmission will possibly be used for future 5-ton assembled trucks. Its outstanding characteristics as shown on the trial runs are: Exceptional power; unusually good springing, making the riding almost as good as that of a passenger car; reasonable economy of fuel; ability to handle cold air and poor fuel without the least difficulty in starting, and ease of steering and control.

#### *Complete Truck Weighs 5 Tons.*

There may also be added the facts that the accessibility is very good, especially of the parts ordinarily requiring adjustment, the assembly easy and the weight of the chassis not so great as was anticipated. The complete truck with body, top and equipment weighs a trifle over 10,000 lbs., the chassis with driver's seat and in running condition scaling 8,600 lbs.

There have been no changes in the design since it was described in the October 15 issue of *The Commercial Vehicle* except that demountable tires have been abandoned and the pressed-on type substituted. The great weight of the demountable type had something to do with this, but the general opposition to demountables from all quarters undoubtedly had its effect also.

#### *Production Indefinite.*

The production schedule for the truck is still under discussion. During January, 1918, 500 trucks are supposed to be delivered, but whether this will be possible or not is as yet not definitely settled. Schedule on the building of the experimental models was beaten and there is every reason to believe that the parts makers will be as good as their word on production. Apparently 10,000 Class B trucks will be wanted during the first six months of 1918 and perhaps half this number of Class A. The standardized truck will take of the Class B requirement, but the Class A will not be available in standard form till later. Mean while the Pierce-Arrow Company will supply practically all the Class A chassis the plant can turn out.

*Achieved Without Sensation*

The creation of the standard Class B truck has lacked the sensational touches which caught popular imagination in connection with the Liberty airplane engine. There were no locked doors, no mystery and no concealment. Yet to design and build completely an entirely new truck in 12 weeks is an accomplishment of which all concerned have good reason to be proud. The total amount of work done far exceeds that of the Liberty motor, and the much wider range of interests concerned by no means made for speed.

It is also a fact liable to escape notice that this truck is a more completely new vehicle than almost any which has ever been built. In the ordinary way a new truck produced by one of the old-line manufacturers is only partly new. It uses some pieces from former designs, and it takes stock parts for ignition, for electric generators, if used, and so forth. On the military truck, the magneto, carbureter and the spark plugs are the only pieces not specially designed. Thus, in comparing the time taken with that usually allotted to getting out a new model, allowance must be made for the completeness of this job. Yet another point to be remembered is that quite a few dies have been cut and parts drop forged instead of being made up by hand.



Photo from *Commercial Vehicle*, Nov. 1, 1917

The Class B truck, assembled at the Selden plant in Rochester, photographed on its way to Washington. Note the absence of the runningboard, electric lights on dash, the rugged bumper and radiator guard



That the adoption of the new standard truck will reduce the list of 2,000,000 parts to 7,500 was in itself an argument for efficiency beyond which the average man would hardly care to go, it would seem. In discussing his experiences, General Baker has told how in France one manufacturer was found to be engaged in the production of no less than seventeen different models. The difficulties and complications involved in keeping a considerable number of vehicles of such widely varying types in simultaneous and successful operation, is requiring of no comment.

### Astounding Magnitude of Parts Need

In facing the task of equipping the American fighting forces there was, at the outset, the inviting opportunity of making use of the accomplished designs, the splendid facilities and tremendous resources of the more successful and larger producers of commercial vehicles here. In a sense here was equipment ready-made. It was not only splendid equipment in its own right, but by reason of heavy sales to the Allies during the war, it had been further developed and reduced to a plane of even greater utility than it had reached through the experience evolved by ordinary business. Not for one moment, however, did the Army recede from its position that the standard truck was absolutely essential.

In this connection it is pointed out by General Baker that it is the policy of the Government to standardize everything connected with the army. Were it not already a tradition of all military operations that uniformity is the basis of strength, the magnitude of the operations involved in the present war would have speedily forced a change.

### Army Standardization the Prime Question

In considering the requirements of the present emergency General Baker does not even permit his mind to dwell for a moment upon the advantages, inherent or comparative, of the existing commercial designs. Pushing all this aside, and taking his position purely from the necessity of standardization and interchangeability of military equipment, he bases his every thought, and is guiding even the smallest activities of the immense organization of which he is the titular head, along the lines of soldierly training, which, inevitably, are the lines that should govern and must govern the activities of the American forces in the war.

So far as can be ascertained, his position is fully supported by the War Department—best proof of all being that the standard truck itself is already in existence, and that the occasion of its formal acceptance by the army was graced by the inspection of the truck in the grounds of the executive mansion by President Wilson. To the general public, familiar



only with the pageantry to politics and the conventional displays of press agency, this last means nothing. To those familiar with affairs in Washington, however, the diversion of the Presidential presence from its accustomed routine for even a few moments is rightly regarded as a deeply significant thing.

### Individual Distinction Sacrificed

Of course, from the individual standpoint of the established truck makers, who, for many years and at untold expense, have developed their own marks to the standpoint of efficiency for which they are so well recognized, even the best built standard truck might fall short in performance of what these special, individualized machines are capable. Nor is there the slightest question that the manufacturers of these trucks are most anxious to give of their very best in the service of the country, and are able to produce most highly creditable results through the concentration of their efforts on the work they best understand, and the work to which their high-strung organizations are keyed.

Even the best that the individual makers can produce, however, falls to the ground by comparison when the feature from a military standpoint of having the thousands and thousands of trucks that will be used absolutely interchangeable, is considered. And when is added to this thought the argument that by reason of the fact that the parts of such trucks can be produced in more than sixty manufacturing establishments throughout the country, Washington viewpoint is utterly unable to recognize any program but the chosen one.

In all action it contemplates, first, the thought that production of standardized and simplified equipment in many widely scattered plants would involve a distribution of effort, a distribution of mental effort, a probable avoidance of labor complications, and last, but not least, the tactical advantage that enemy operations would have to be far flung indeed to cripple production. In point of operation there is first to be considered the reduction of supplies to a minimum, both for transportation and storage purposes, and, second, the simplification of repairs, so that salvage of damaged equipment could be rapidly carried forth and new trucks built out of old with the smallest possible difficulty and delay.

The individual trucks, of which the industry itself is so proud, are by no means to be ignored. Even now they are being bought and built in quantities, and many more will be used as time goes on. The operation of these trucks in the service of the Allies is eloquent of their capability, and not even the exigencies of the military program will permit of their being lost to usefulness either abroad or at home, but particularly in the operations behind the lines. "Over There," however, the building of new trucks out of old ones will one day be a most

pressing and active industry, and it is to the effective prosecution of that industry that the energies of Government activity today are being particularly devoted.

As far as the automobile industry is concerned, the whole weight of the Government seems to be more and more concerned with the simplification of industrial operations behind the lines, and the co-ordination of all manner of industries in business of war. Over all things else, this takes precedence, and is creating precedents of its own for the reason that its requirements are entirely distinctive, and that the considerations that weigh most at the present time are certain ones that do not appear in connection with the normal activities of commercial life.

### Standard Trucks Only "War Material"

In the broad sweep of the war program the standardized trucks, which mean so much to the automobile industry and represent so much of its individual and devoted effort, are nothing but "war material," representing, in a way, hardly more than a minor fraction of the activity that is in contemplation. While the standard truck occupies the center of the stage, figuratively speaking, just at the moment it actually represents "merely" the means of equipping the field transport division of the Quartermaster Department. Ordnance, signal and sanitary services likewise are extraordinarily interested in the motor vehicle—so much so that in ordinary times the activities of either one of them would constitute an event that this industry would discuss with eagerness for at least a year. Yet all these activities in the purchase and use of motor vehicles—constituting, all told, many times the normal commercial market for motor trucks—when taken together constitute but a very small part of the war program, and however vital they may be in their effect upon the grand result, can never exceed their normal rating as fractional items among the supplies that the war is absorbing. With standardization—or, better yet, with regulation—as the basis of every thought in connection with war purchase, therefore, it is but normal that those who have to do with the motor vehicle side of the program should be absolutely deaf to every other argument than that which is based on equipment uniformity.

Even in the event of a perfect interchangeability of parts and the absolute standardization of materials, the quantity of parts involved in carrying out the program that is in view is simply staggering. Developing this line of thought, officials having the by no means simple program before them took the stand that it would be thoroughly possible for the industry to build trucks, not for the Government but for the war. This they have done, and in doing so they have come to regard the new design not as a government truck but as a piece of public work, conceived, fostered, developed and executed not

so much by officials as by and for and with the public, as embodied in the chosen representatives of the industry. And in viewing the work that has been accomplished thus far, they feel that they have done the job.

Operated with no regular basis of supplies, divided by an ocean from the original source of materials, parts and skilled labor, the service that these trucks are to perform is in all ways extraordinary. With their often almost devilish foresight, the Germans have fortified many of their actions by building some of the finest highways the world has known. Unheralded thus far, they have mapped out hundreds of miles of important territory with military roads over which supply trains move with regularity and dispatch. Within the scope of other activities in which the new equipment of the United States will be called into play, however, there is anticipated a vigor and dispatch that will leave no time for road building. The trucks of the new standard will go into service where there are no roads, and in traversing the horrid tracks of "No Man's Land" must perform their service with a regularity heretofore never equalled by the best of commercial performance. It is required of them that they must operate first on such supplies as can be carried with ease under transport conditions governing their own operation, and that the mobility of the entire haulage system of the army shall be measured by the mobility of the trucks. Here is an undertaking to shock from its accustomed self-sufficiency even one of the greatest, most self-sufficient and successful of all the industries.

### DETAILS OF THE NEW TRUCK

Firstly, the wheelbase is 160 in., the engine  $4\frac{3}{4}$  by 6 in., 424 cu. in., the transmission a four-speed, amidships, the clutch a dry disk inclosed in the bell housing, and the rear axle a worm-drive, full floating type. Steering is by worm and worm wheel. Fuel feed is by gravity from a 15-gal. tank on the dashboard, there being a 16-gal. reserve tank under the seat, and ignition is double, with battery and magneto systems entirely separate. The frame is pressed steel, of channel section, and quite straight; the springs are almost perfectly flat, and Hotchkiss drive is used. Both brakes are internal and on the rear axle. Taken as a whole, there is nothing peculiar in the design except its unusual strength for the load capacity. It is really a 5-ton truck, and will probably weigh about 8500 lb. for the chassis with wheels and tires but without any body parts.

Probably there has never been a better designed engine. Seeing the collaboration upon it, the design ought to be quite above the normal, and the careful detail is not done justice in a mere word description. Three particular points have been kept in mind throughout—first, the best possible lubrication; second, the provision of a water jacket reaching every smallest



point likely to become hot; and third, rigidity without excessive weight. Additional points of note are a conspicuous cleanliness of exterior and an entirely inclosed governor mechanism of great simplicity which positively cannot be tampered with when once set.

### Engines Have Detachable Heads

The cylinders are cast in pairs, with detachable heads, each head being secured by thirteen studs. The two spark plugs are located side by side, with a water space between their bosses, right in the center of each cylinder, and as an example of careful detail the water outlet pipe, which is a brass built-up proposition, is offset enough to allow easy access to both plugs with a socket wrench. All the combustion space is in the head castings, the tops of the blocks being faced flat, the valve heads standing up a little from the surface. All valves have ports  $2\frac{1}{8}$  in the clear, and are tungsten steel head and stem, with 60-lb. springs. The diameter of  $2\frac{1}{8}$  is maintained on the exhaust ports right out to the manifold flange, but the intake is restricted to  $1\frac{11}{16}$  in. at the flanges, the desire being to maintain a fairly high velocity right up to the moment of entering the cylinder. The cylinder walls are  $\frac{5}{16}$  in. thick. Water completely surrounds each cylinder and each valve seat.

Following up the security assured the heads by the use of 13 studs  $\frac{1}{2}$  in. in diameter, each block is attached to the crankcase with seven  $\frac{3}{4}$ -in. studs, the base flange being  $\frac{1}{2}$  in. thick at the thinnest points and 1 in. thick at each holding-down stud boss. The water inlet flanges, which are on the sides of the blocks remote from the manifolds, are  $\frac{13}{16}$  in. in diameter, and the outlets on the head castings are the same size.

The crankcase is all aluminum, including the bell housing and the oil pan. The bearings are very rigidly webbed, and the whole case is as stiff as could well be imagined. At the rear end there are two deep arms which act as the rear supports. Here the diameter of the case and of the flywheel housing is such that the arms are extremely short, and they are formed in such a way that the top of the bell makes a complete arch construction from tip to tip of the arms, so adding considerably to their natural strength. The front support is a spigot on the front-end cover, turned and held in a swivel collar on a dropped cross member of the frame, so giving a three-point support with sufficient flexibility to counteract all stresses in the main frame.

### Lubrication Entirely Pressure

Complete pressure lubrication is used, even to the extent of feeding the wrist pins by means of tubes secured to the connecting-rods. Oil is fed to the three main bearings, thence by straight holes diagonally to the crankpins, and thence to the wrist pins. The pump is in a well at the extreme rear right



end of the crankcase oil pan, where it is separated from the rest of the system by a wall that prevents oil falling from the bearings from entering without first passing through the screening system, which is very elaborate.

The forward portion of the pan is very shallow, so as to give great clearance over the front axle, and sloped toward the deep rear end, which contains all the oil. The top of this sump is closed by a sheet of thin steel having in the center a funnel reaching nearly to the bottom of the sump. This funnel is surrounded by a wall reaching nearly up to the sheet steel just mentioned; so that oil has to pass down the funnel and then up again over the wall, the chamber into which the funnel discharges being thus always full. This is the settling chamber, designed to catch all particles of carbon and impurities and prevent them from passing on into the main oil reservoir. However, after passing over the wall beyond the funnel there is still a large screen of wire mesh to be passed, and another screen is used on the actual pump intake. This makes the oil circuit from pump to bearings, to settling chamber, to first screen, to second screen, and then round again. The settling chamber can be drained by a plug in the bottom, and draining it does not affect the main body of the oil, so very little need be wasted.

### Has Roller Tappets

The tappets are housed individually in the crankcase, each being a complete assembly of roller, hollow adjustable plunger and guide. They are held in in pairs by dog clamps and studs. Timing is as follows:

|               | Opens         | Closes       |
|---------------|---------------|--------------|
| Exhaust ..... | 45 deg. early | 5 deg. late  |
| Intake .....  | 12 deg. late  | 35 deg. late |

There are three diameters for the camshaft bearings,  $2\frac{1}{4}$ ,  $2\frac{1}{8}$  and 2 in., their lengths being  $2\frac{1}{4}$ ,  $1\frac{3}{4}$  and  $1\frac{3}{8}$  respectively. On the rear end of the shaft there is a skew gear driving the oil-pump shaft, this being the extreme end, beyond the rear bearing. Thrust from the gears is carried to the front end of the shaft, and resisted by a spring-backed hard-steel plunger which sets in a socket in the front-end cover. The pump shaft is, of course, vertical, and the coupling to the pump itself consists of a short coil spring with the ends bent across the coil diametrically. Both the drive shaft and the pump shaft are slotted and the ends of the two nearly meet, the bent-over extremities of the springs setting in the slots. This allows the oil pan and the pump with it to be removed and replaced with a minimum of trouble.

In the front end there are four gears; the crankshaft pinion, pressed on the end of the shaft; the camshaft wheel, driving the generator gear; and, on the other side, the gear for water

pump and magneto. The governor motion attaches directly to the front end of the camshaft.

Thus, on the right side of the engine are the generator, the carbureter, and both manifolds, while on the left are the water pump, magneto and battery ignition distributor, the latter being set on top of the front-end case, where it can be driven by skew gear off the water pump drive shaft. This makes for ease in linking together the magneto and the timer advance controls, and keeps all wiring on the one side of the engine.

The governor consists of steel balls held between a disk that can slide forward against a spring, and a female cone fixed to the camshaft front end. In moving forward, the disk bears upon the short end of a vertical lever, the upper end of which is linked to a throttle in the intake manifold just above the carbureter attachment flange. This lever is fully inclosed, and the spring which pushes against the centrifugal action of the balls is set in the case halfway up the lever. Here there is a threaded plunger with a lock nut, by which the pressure on the spring is set, and both pin and lock nut are secured when set by a sealed wire that entirely prevents unauthorized adjustment. The throttle, operated by the governor, is the usual butterfly sort, but the spindle is set a little off center, so that the suction of the engine tends to open it, this making for a quick reopening and preventing sluggish action.

The water pump is a separate assembly, and its shaft is coupled to the drive shaft, which is set in the crankcase and carries the gear. This makes the pump detachable without disturbing the front end. The magneto is set well back on the left side, and is coupled to the rear end of the pump shaft. Clearances are large, and no accessory is placed awkwardly.

### Has 130-Lb. Flywheel

The crankshaft is a conventional design, although a counter-weighted shaft is to be tried. The diameter is  $2\frac{1}{2}$  in. on the three main bearings and  $2\frac{3}{8}$  on the pins. The bearing lengths are 4 in. for the rear and middle bearings and  $3\frac{1}{16}$  in. for the front, the pins being 3 in. long. The webs are very stiff, the long ones having a section  $3\frac{3}{4}$  in. wide by  $1\frac{3}{4}$  in. thick at the thickest point, the 7-deg. draw angle subtracting little from the thickness at the edges. The proportions allow perfectly straight holes to be drilled for the oil direct from each main bearing center to the pin centers. For the flywheel attachment there is a flange.

The flywheel itself is exceptionally large, being 20 in. diameter and 4 in. wide on the rim, the weight being 130 lb.

The cast-iron pistons are fairly heavy,  $6\frac{1}{8}$  in. long and with three rings and a  $1\frac{3}{8}$  hollow wrist pin locked in the piston. The pin center is  $2\frac{5}{8}$  in. from the bottom of the piston. Ten-thousandths clearance at the top and over the upper ring is

called for, and four-thousandths on the lower ring and the rest of the skirt.

The manifolding system is designed to take care of heavy gasoline, and is regarded as the most experimental thing about the engine. The exhaust manifold is conventional, except that at the center it has a rectangular opening. The intake ports are below the level of the exhaust ports, so that the intake manifold flanges can be attached, and the intake manifold branches come out and up in an easy sweep. Where they join there is a rectangular face matching the one on the exhaust manifold, and a sort of box like a muff on the intake. These two faces bolt together, with a gasket, thus allowing the exhaust to play upon the point where the two branches of the intake connect with the short vertical part containing the governor throttle and ending in the carbureter flange. The carbureter is set quite high and will, of course, be a vertical model, though the make is entirely undecided and will in fact be settled by trial only.

The rest of the chassis has been described in more detail before. Concerning the multiple dry disk clutch there is little to be said, except that the throwout bearing is much above the average size. The gearset with its four speeds and the two shafts in the same horizontal plane is much as it was first sketched out. It is an excellent manufacturing proposition and will weigh about 300 lb. A short shaft links it to the clutch via two metal universal joints.

The transmission is rather ingeniously hung. At the rear are two lugs drilled to receive pins on a transverse axis, and these pins also pass through the ends of a pair of brackets hanging from a plain pressed steel cross member. The front end of the case has a "nose" surrounding the bearings of the main shaft, and this nose is held up to a bracket hung from another cross member by a cap like a bearing cup. The cap does not grip the case tightly so as to allow a certain amount of floating fore and aft movement.

This suspension makes it very easy to remove the case, since it is only necessary to remove the cap and knock out the two pins at the rear after disconnecting the pins in the three gear striker rods and disconnecting a universal joint in front, the slip joint takes care of the universal on the propeller shaft.

The last mentioned is normally almost horizontal, in a practically perfect position for the Hotchkiss drive.

The axle, though it contains much that is new, is mainly Timken in exterior. It is a full floating pattern with a pressed steel case and has taper roller bearings all through, even on the worm shaft. As stated before, both sets of brakes are expanding, side by side in the same drums. These brakes are of the band type and are provided with adjustment for setting the concentricity of the bands. In laying out the brake con-



nections great care has been taken to plot the paths of the brake lever eyes as the spring deflects, and the cross shafts, of which there are two, are placed so that axle movement will have a minimum of effect upon the brakes. To compensate for torsional deformation of the spring the axle brake levers are carried up till the eyes are nearly in line with the top plate of the spring, thus resulting in spring deformation causing an up and down movement of the levers instead of a horizontal one, and the vertical movement does not affect the tension on the brake rods.

### SUMMARY OF PRINCIPAL POINTS

1—The engine has four  $4\frac{3}{4}$  by 6 cylinders, cast in pairs, with detachable heads.

2—Much attention has been paid to the cooling and lubrication problems.

3—Force-feed lubrication is used throughout and the oil is doubly strained.

4—Two entirely separate ignition systems, one battery, the other magneto,, are used.

5—The crankcase, including the bell housing and the oil pan, is aluminum. Three-point support is used.

6—The crankshaft is very rugged, and is notable for its large intermediate bearing, as long as the rear one.

7—The governor is the steel-ball type, and so inclosed and sealed that it cannot be tampered with.

8—There is a dry disk clutch, a four-speed horizontally arranged change gear, a worm drive, a full floating rear axle and Hotchkiss drive.



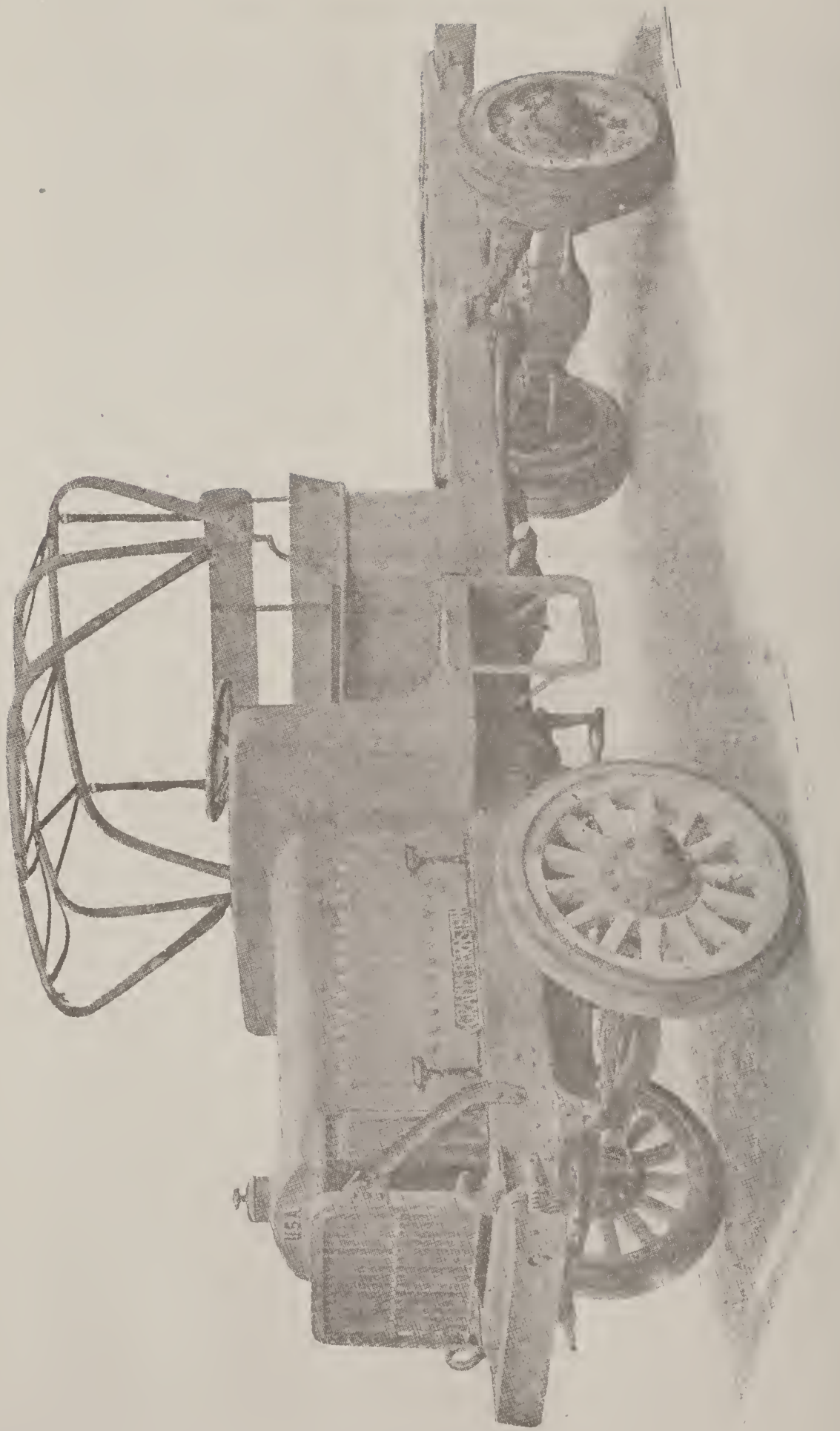


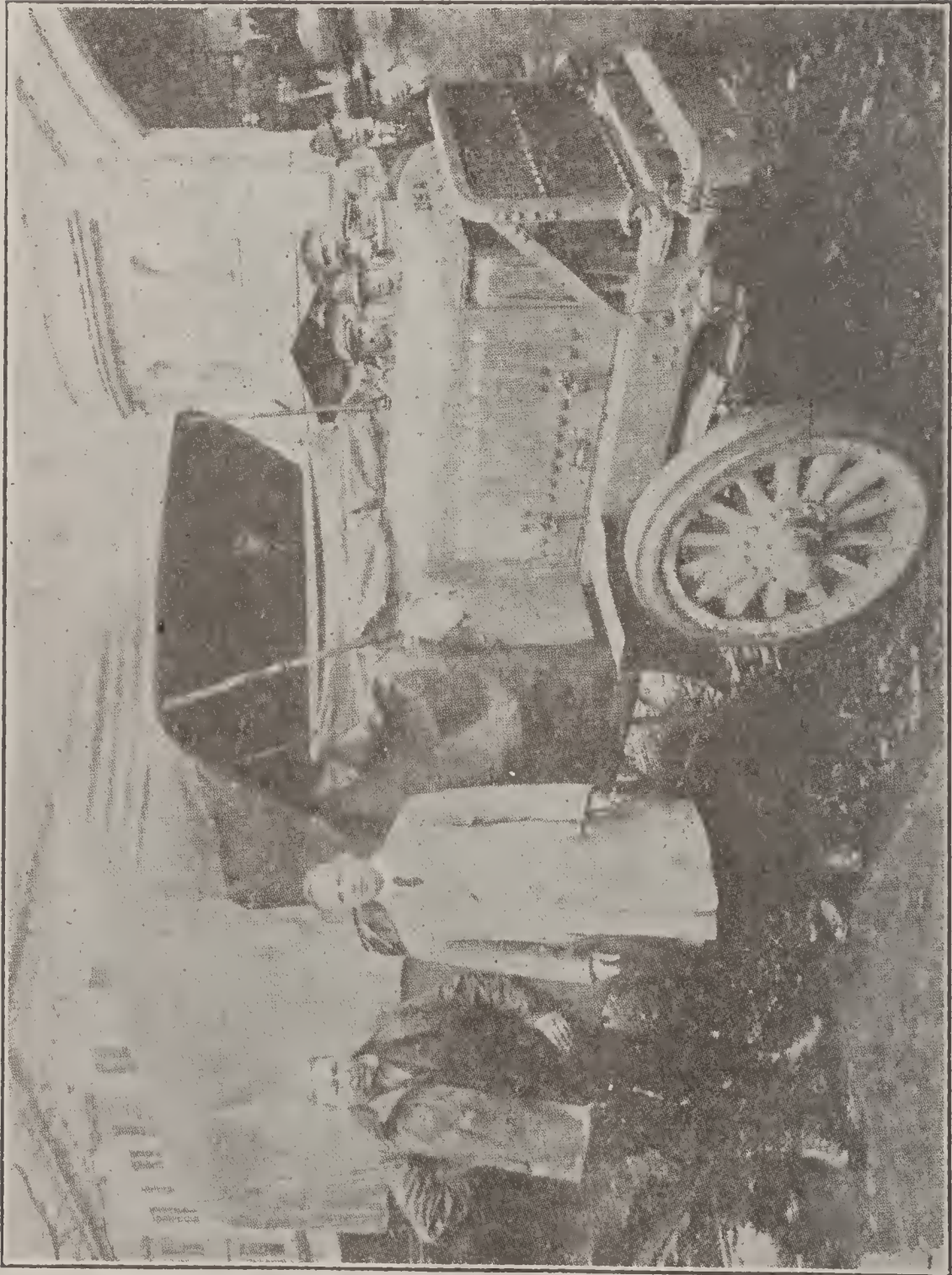
Photo from Commercial Car Journal, Nov. 15, 1917

One of the First Two Heavy-Duty War Trucks Before the Body Was Put on. This One Was Built by the Gramm-Bernstein Co., Lima, O.



The Class B truck, assembled at the Selden plant, off the road on the run to Washington. One of the surprises of the trip was the fact that the engine could not be stalled, no matter how far the rear wheels sank. It would seem that as long as traction can be had the truck can pull out of any difficulty





Other of the First Two Standard Trucks, Built by the Selden Motor Truck Corporation

## CHAPTER X

### THE TRAINING OF SUPPLY TRAIN TROOPS

Introduction.—The problem which was presented to Supply Train officers of the first National Army divisions will probably not be exactly duplicated by any others.

They were without trucks for several months, with no definite time to look ahead for them, and had to push and dig for everything they could get to give the men instruction and training directly applicable to their function in the field, and at the

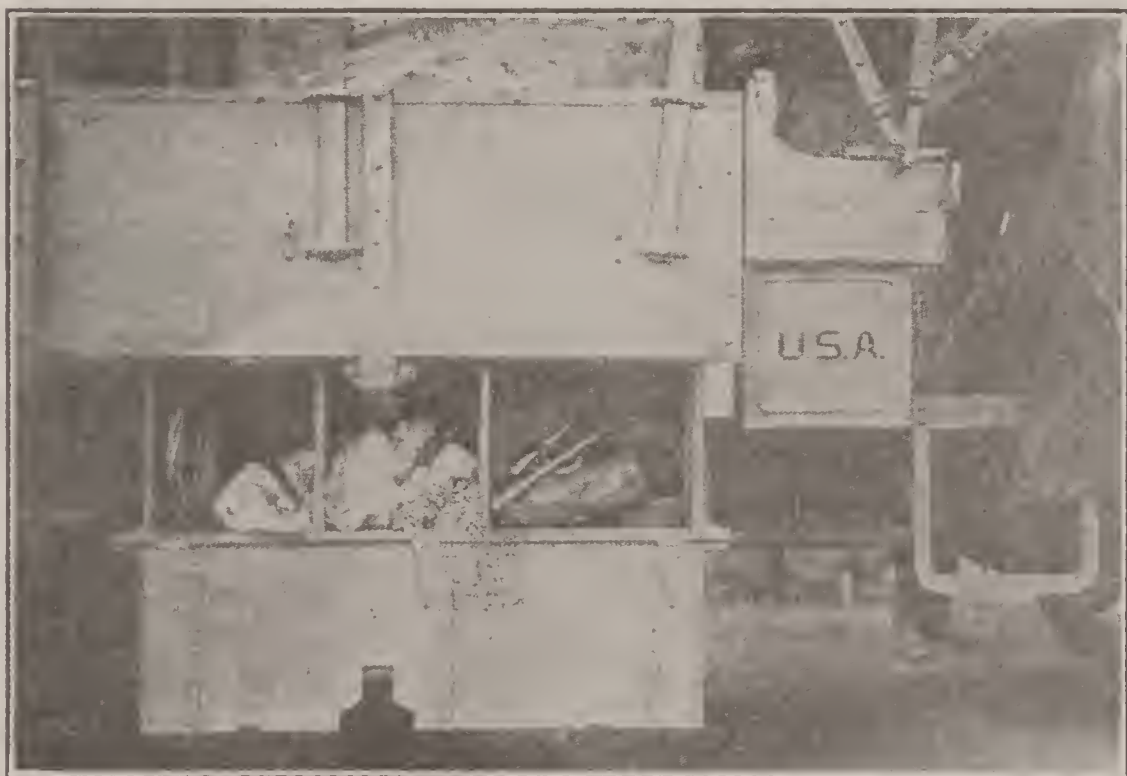


Photo from Commercial Vehicle, Nov. 1, 1917

A close-up view of the generous-sized toolbox fitted on the Class B truck under the body on the right side. Note also the metal stirrup step, which is much lighter than the conventional runningboard and yet serves the same purpose

same time continually devise means of occupying the men's time which was left, in training and instruction, which, while not directly applicable to their work, would not be wasted. In the outline which is given in this chapter of work to be covered in those lines which are not absolutely essential, it serves to indicate into what fields the work may go, as time shall allow. However pertinent a field of instruction is, officers should bear in mind always, that, to be of any value, it must be systematic and progressive. Where there is no connection between one day's work and another, it loses its meaning; connect a subject of



training and instruction, make it progressive, and you have arranged it in a man's mind, so that he has learned something. Further than this, the attitude of each officer should be one of constant alertness to improve his own knowledge of his job, to discover new means of improving the training of his men, and new data with which to make the work more valuable and interesting to them.

### Part 1

## INFANTRY DRILL REGULATIONS

The chauffeur is no less a soldier than the rifle-man; there is probably no more important fact to realize than this in the training of Supply Train troops. When a chauffeur is given an order from a superior in the field, he must obey it with the same habitual obedience with which the infantry-man follows his platoon leader in the charge. To get the chauffeur in this attitude of mind is not the task of a few days.

Close order drill—school of the soldier, squad, and company should occupy a prominent place in early training; to implant this necessary discipline thoroughly into the men, an hour a day throughout the training period would not be wasted.

The men being armed with rifle, Extended Order Drill is not out of order, and its mechanism, as outlined in the School of the Squad and School of the Company should be taught them.

### Part 2

## PHYSICAL DRILL

The men's physical development should not be overlooked any more than for a soldier of any branch. Physical drills should occupy about three quarters of an hour, and follow progressively the lessons outlined in "Field Physical Training of the Soldier" issued by the War Department.

### Part 3

## MUSKETRY TRAINING

The Supply Train fires special course C., Appendix II, Small Arms Firing Manual, and should have the regular preliminary training for target practice: care, description and cleaning of rifle, from pamphlets on the rifle issued by the War Department; sighting exercises, position and aiming drills, deflection and elevation connection drills as prescribed in Small Arms Firing manual, and the Bull's Eye Score Book. Further time available may be devoted to instruction of the men in the theory of fire, use of the mil scale, target designation, determination of ranges, estimating distances and use of cover, from War Department Document No. 631, entitled "Musketry," and also from Small Arms Firing Manual.

## Part 4

### GUARD DUTY

Thorough instruction in the principles and execution of guard duty should be given. As soon as possible a guard should be established for the Supply Train's sector of camp and maintained through its occupation thereof. Its special service in the training camp would be to watch for fires, but the instructive purposes for the men, in putting them on guard duty, should not be lost. A form of guard orders in a motor unit camp is given on page 143.

## Part 5

### SIGNALLING

Both semaphore and wig-wag systems of signalling should be taught, and by competitive work the best signallers can be determined. The messenger should be a competent signaller, and there should be a few other men especially trained for this work. Arm and whistle signals for infantry work, as given in Infantry Drill Regulations, and truck signals as given on page 127 of this book, should be included under this head.

## Part 6

### MILITARY FORMALITIES AND ENSIGNIA

Each man should be taught, beginning with his first day of training, the proper observance of military formalities and courtesies, for which the best material is Moss's "Manual of Military Training" Part VI. He should be taught the insignia of rank and branch of service of officers and the chevrons of non-commissioned officers shown on page ..? of this book. He should be able to describe the American Flag.

These matters need more than a single recital for the men to know them. They should be drilled in the mechanism of the salute, drills should be invented covering assumed situations for practice in doing the correct thing, and the men should have their attention called to errors or omissions in conforming to military custom. Teach military courtesy so that men will not consider its observance humiliating or even perfunctory, and on the other hand be careful not to give them an overdose of the "grand and glorious privilege" idea. Above all don't read out of a book on this subject, make your explanations yourself, and when you have them, your sergeants can help you out a great deal in this instruction.

## Part 7

### LECTURES

An hour a day for two or three days a week could be devoted to a series of lectures by the company commanders on matters

which would be of value to the men. It is suggested that the first of these be on the organization of the division with particular reference to the position and general function of the Supply Train; surely first the men want to know where they fit into the army, and who their superiors are. Well organized talks and readings from Army Regulations, covering points with which individual soldiers should be familiar could follow this. Then talks on the detailed organization and the operation of the Supply Train, for which it is believed this book could serve as a basis, would be in order. If time allowed, it would not be wasted in talks on the function of other branches of the service, for the men of the Supply Train will have dealings with men of all branches of the service, and the more they know them, the more intelligent will be their service.

## Part 8

### FIRST AID

First Aid instruction is highly important, and each man in the company should know exactly what to do in all emergencies requiring first aid treatment. Valuable data on this subject may be obtained from Hastings, "First Aid for the Trenches" (Harvey Military Series); Moss, "Manual of Military Training," Part V, Chapter 3; Field Service Pocket Book, Pages 582-616; Manual for non-Commissioned Officers and Privates, Chapter XIII. Below are printed a series of lessons on First Aid which were given in one of the companies of the 301st Supply Train, the above named books being used as the chief sources. Not a great deal of material is given in a single day, for every bit should be thoroughly grounded. The method followed in the company mentioned was to have the members of the company study the day's assignment by sections under the section leader, who was provided with a type-written copy; after a half hour of this, another half hour was spent under the direction of the company commander, in conference over the work, in practical demonstration of methods mentioned, and from time to time in written tests. Charts of the body are particularly valuable in the study of bleeding. The use of the outlines given at the ends of each lesson should also be of assistance in organizing the subject.

Plates shown in Hastings "First Aid for the Trenches" are excellent for illustrating material on Treatment of Wounds and Fractures, and on moving injured persons.

### LESSON I. TREATMENT OF WOUNDS

1. The three principal dangers which result from rifle, shrapnel, or other wounds are:

1. Shock.
2. Infection.
3. Bleeding.

2. The first thing to do then is to prevent shock. The



vitality of a wounded man is lowered, especially at first. He must therefore be kept warm and should be covered by an overcoat if such a thing can be obtained. Any movement increases shock. Therefore, when a man is badly wounded, if he is not bleeding, it may be useful to move him to a dugout or other place of safety and let him rest for an hour or two before removing him to the dressing station, if he is conscious, and able to swallow, a little hot soup, tea, or coffee may help him. Where he is exposed to the enemy fire he should of course also be assisted to cover whenever this is possible.

3. a. The second thing to be done is to dress the wound, if the bleeding from it be not severe. The fundamental thing to remember here is to guard against infection. To guard against this, the greatest possible cleanliness is necessary in the dressing of wounds. Any dirt or foreign matter introduced into them greatly increases their danger and the time occupied before they are healed. Lack of care shown in keeping anything soiled or dirty from the wounds will surely introduce poisonous germs into the wound, which prevents them from healing readily, and give rise to a thick discharge from them, and may take away a man's chance of recovery from them.

(b) These precautions should include care that the hands do not touch the wound at any time, that nothing soiled or dirty is used; nothing should come into contact with the wound but the inner layer of the dressing where it has not been handled. If the dressing contains a small tube of iodine, this must be opened and poured on the wound and surface of the skin about it.

(c) The soil of Belgium and France, which has been cultivated and manured for generations, is bound to be full of some of the worst varieties of bacteria. War wounds are bound to be dangerous in respect to poison at best, for if a man is in action long he can be sure neither he nor his clothes will be anything like free from germs, and when a man is wounded these will readily be carried in; shell or shrapnel will also very probably carry soiled pieces of clothing directly into a wound. Disease germs are such tiny things that they can only be seen with the strongest microscope, but they multiply very rapidly, and are possessed of such wonderful vitality that some of them have to be boiled for ten or fifteen minutes, or exposed to steam for the same time, before they are killed.

(d) What measures can be taken to kill the germs which are likely to be inducted into a wound? The surgeon boils his instruments before dressing a wound, and the dressings which he uses to cover it have generally been exposed to steam and then dried. Various chemical poisons will also kill germs. Carbolic acid is perhaps the best known of them, and is useful if the wound is fresh; but if it has been made some hours before, the germs will have multiplied in it and some of them will have got into the flesh around the wound where they can't be reached



by the carbolic. Early treatment is therefore necessary. The best germ destroyer is iodine.

(e) Even slight wounds and scratches should be covered up at once by a bandage or a handkerchief to prevent dirt getting into them. Where possible, a medical officer should be notified when tiny wounds have had soil rubbed into them, because a wound containing soil and from which the discharge cannot come away freely is liable to cause lock jaw.

In connection with gunshot wounds it is necessary to remember that in many cases, the bullet is not stopped by the body, but passes right through it. Two wounds have therefore to be looked for and both treated with iodine and dressed.

(f) In dressing a wound, take care to use that belonging to the wounded man and not your own. Apply the dressing and bandage firmly on. Do not bandage too tightly, especially over bony parts, such as the wrist or ankle, as there is danger to the limb if you do so, as the flow of blood through it may be arrested, and the limb thereby die.

(g) Following are directions for applying the U. S. Field First Aid Packet:

1. If there is only one wound, carefully remove the paper from one of the two packages without unfolding the compress or bandage, and hold by grasping the outside rolls of bandage between the thumb and fingers.

When ready to dress wound, open compress by pulling on the two rolls, being careful not to touch the inside of the compress with fingers or anything else. The back of compress is marked by a strip of blue paper. In grasping the rolls, if the thumbs are slipped in the spaces marked by the blue strip the face of the compress will not be touched. Still holding one roll of the bandage in each hand, apply the compress to the wound, then wrap the bandage around the limb or part and tie the ends together or fasten with safety pins. The second compress and bandage may be applied over the first, or it may be used for a sling if the arm is wounded or to bind both legs together if one is injured.

2. If there are two wounds opposite each other, apply to one wound a compress without unrolling the bandage, and hold it in place by the bandage of the compress used to cover the other wound.

3. If there are two wounds not opposite each other, tie the compress over each.

4. If the wound is too large to be covered by compress, find and break the stitch holding the compress together, unfold it, and apply as directed above.

5. Bleeding.

(a) Every wound gives rise to a certain amount of bleeding. In cases where it is not severe, no particular attention need be

paid to it, the pressure effected by the firmly bandaged dressing sufficing to arrest it; where, however, the bleeding is severe, efforts must be made to stop it before applying the dressing.

(b) There are two kinds of bleeding: venous or arterial; venous from the large veins, arterial from the arteries.

Veins are carrying blood back to the heart (via the lungs) and when they are cut pressure must be brought to bear on the side of the wound away from the heart to stop bleeding. Arteries are carrying fresh blood out from the heart and hence bleeding from them must be stopped between wound and heart. There is a difference between bleeding from veins and from arteries so that one can tell on which side of wound to bear pressure; blood from veins is very dark red, flows or comes out in steady bubbles; blood from arteries is bright red and comes out at first in spurts corresponding to each heart beat.

(c) Most all venous bleeding can be stopped without resort to pressure on the blood vessel; and the following procedure will usually suffice. Lay the patient down, remove any constriction which may be around the limb, elevate the limb, and apply a pad and firm bandage; where it is a trunk wound, leave out the words "elevate the limb."

1. A wounded man should be kept as still as possible till all bleeding has stopped, because movement stimulates the heart to pump the blood more vigorously through the body, and this usually increases the bleeding.

The following paragraphs will give in detail the procedure for stopping bleeding at different parts of the body, arterial bleeding being taken for granted except where otherwise noted:

2. Bleeding from a limb—an arm or a leg. It is usually best to make no attempt to purify the wound, but at once to raise the injured part, getting the soldier to sit or lie down (especially if the leg or thigh be wounded). If pressure from pad and bandage will not stop it, something must be tied tightly round the limb to press on the arteries conveying blood to wound, which may be done easiest by means of a tourniquet.

An improvised tourniquet may be made as follows. Take a handkerchief, a smooth rounded stone, and a stick or scabbard, etc., wrap up the stone in the center of the handkerchief around the limb and then tie securely, leaving sufficient space for the stick to be admitted; pass the stick then between the handkerchief and the skin and carefully twist it until, by tightening the handkerchief, the stone is pressed upon the artery with sufficient force to arrest the flow of blood. A pad should be placed between the stick and the skin to prevent the latter being bruised, and the end of the stick must be secured with a bandage to prevent the tourniquet untwisting. The tourniquet should be applied no tighter than is absolutely necessary to stop the arterial bleeding and should only be used as a last resort.

Seeing that tourniquet cuts off all the fresh blood from the

limb beyond it the tourniquet must not be left on too long or the part will die. The arm can manage without blood fairly well for as long as 3 hours, but there is danger in leaving a tourniquet round the leg for more than half this time. Therefore, when a tourniquet is applied skilled help must be obtained with as little delay as possible. Where this is impossible it is best after an hour to loosen the tourniquet a little, being always ready however to tighten it up again if bleeding starts afresh.

3. From the Head.—With a severe wound of the head the skull is often broken. Firm pressure by a pad and bandage is therefore liable to press a piece of bone into the brain, and is to be avoided. It is better to stop bleeding by pressure on the arteries going to the part. For bleeding in the front half of the head press with the thumb just in front of the ear of the side of the head injured; for the back half press two inches behind the ear and a little below, using the thumb as before. The beat of the artery can generally be felt in the former, but very rarely in the latter.

4. Bleeding from the Face.—Though a wound of the face may bleed freely, this is easily stopped by a pad of dressing pressed firmly on the wound and held in position by the hand.

5. Bleeding from the Neck.—A wound of the neck is one of the most serious in the body, because large arteries and veins exist on either side of the wind pipe. It is of course impossible to put a tourniquet round the neck, as this would cause suffocation. The proper thing to do is therefore to press on the blood vessels on each side of the wound. The artery and vein run together side by side, and if one is wounded the other is almost sure to be injured as well, and the result is that the artery carrying blood from the heart will bleed chiefly from the body side of the wound while the vein will bleed from the head side. Fortunately it is rare for both of the main arteries, which are situated one on each side of the wind pipe, to be injured at one time, for it is very dangerous to press on both at once to stop bleeding, as this cuts off nearly the whole of the blood from the brain.

When the neck is wounded and bleeds freely, kneel down on the wounded side of the patient, who will be lying down, and put the tip of each of your thumbs so that it just touches the wind-pipe, one on each side of the wound and about an inch from it, and then press straight back on the spine.

If this does not stop the bleeding shift the position of one or both thumbs a little and try again. In most cases you will have to keep the patient just where he is, and go on pressing until skilled help arrives. If the wind-pipe is injured try to turn the patient into such a position that any blood that may trickle into it will run out again at once.

6. Bleeding from Chest and Back.—Cover the wound with dressings and press firmly with the hand. Where the patient



coughs up blood as the result of the lung being also injured, he should lie on the injured side, so that the opposite lung is most used for breathing. He should be covered up and kept warm and as still as possible.

7. Bleeding from the Stomach.—Wounds of the stomach rarely bleed much externally, but they are none the less serious because, if severe, they are very liable to become poisoned from the bowel. The person affected should be kept warm and move as little as possible, and must on no account walk. If the bowels are protruding through the wound they should not be pushed back, but should be covered by the gauze from the first field dressing. If obtainable a clean handkerchief should be placed over this, and then the sides of the tunic should be brought together over both and fixed with pins; or, if they will not meet easily, the opposite buttons and button-holes can be tied together with strings. If wound is deeper than the skin no iodine should be applied. The knees should also be bent up and the shoulders raised on a folded coat to loosen the wall of the stomach and prevent pressure on the injured organs. After bullet wounds and other injuries to the stomach give nothing to eat or drink, move very carefully, and inform the medical officer as soon as possible.

8. Bleeding from the Shoulder.—For bleeding from the shoulder and upper arm, too high up for a tourniquet to be applied between the trunk and the wound, place a pad of dressing on the wound and hold it there, pressing firmly. When all bleeding has ceased the hand may be replaced by a folded handkerchief, which is firmly bandaged into place: but if the bleeding starts again we must press on the wound once more. If, however, pressure on the wound is not enough to stop the bleeding, press the thumb just behind the middle of the collar bone, where the beating of a large artery may be felt, and hold it there till help arrives.

9. Bleeding from the Hip.—For bleeding from the hip too high up for a tourniquet to be applied, pressure by means of a pad of first field dressing, pressed firmly on to the wound, should first be tried. If this fails, or if immediate swelling around the wound occurs, we must press on the artery going to that part. The artery is situated a little to the inner side of the middle of the front of the thigh, but it is sometimes difficult to feel its beat. The two thumbs should be placed one over the other in the situation of the artery and pressed directly backward. If the bleeding does not at once get less, move the thumbs a little to one side or the other side and then press again.

10. Bleeding from the Mouth.—Sometimes bleeding from the mouth can be stopped by direct pressure of the finger, covered with the colored gauze from the first field dressing, on the bleeding area in the man's mouth. If this is not successful, pressure on the blood vessels of the neck, on the same side as the wound, should be tried, and the wounded man turned on to his



side so that any blood flows out of his mouth instead of running down his throat.

11. Bleeding from the Nose.—Bleeding from the nose from injury or disease can generally be stopped by pressing the two sides of the nose together with finger and thumb as far back as can be reached, holding it thus for ten to twenty minutes. If however, while this is being done, blood flows down the throat and is swallowed, or is spat out from the mouth, the treatment is useless and should be discontinued. The patient should then lie on his side so that the blood flows out from the nose and does not run down the back of the throat.

12. There is no special first-aid treatment for vomiting of blood from an injury to the stomach, beyond keeping the patient lying down at rest and as warm as possible.

13. Bleeding into a Limb.—Sometimes a rifle bullet may pass into or through a limb, causing injury to a large artery, but tearing the rest of the limb very little. Blood will be poured out, but may be prevented from reaching the surface owing to swelling along the track of the bullet; or the sharp end of a broken bone may cut into an artery. In either case there will be a sudden swelling of the limb, which rapidly becomes larger. This must be treated at once by applying a tourniquet on the body side of the swelling; or if this is impossible, as in the case of the shoulder and hip, by pressing on the artery going to the part.

6. Wounds of Joints. Wounds of joints are liable to be very serious if dirt gets into them. Every care should be taken to prevent this by the early application of the first field dressing, and soldiers thus wounded should be moved to the nearest dressing station as soon as possible. As iodine is liable to cause inflammation of a joint, care should be taken to apply it only to the skin around, and to try and prevent any running into the joint itself.

7. Internal Bleeding. The symptoms of internal hemorrhage are prostration and weakness. The surface of the body is cold and the face pale, the lips lose color. The pulse is weak or imperceptible; there is sighing respiration and a cold, clammy sweat. Keep the patient absolutely quiet and do not give stimulants.

#### OUTLINE

1. Principal dangers from wounds.
2. Prevention of shock.
3. Dressing the wounds.
  - a. Necessity of guarding vs. infection.
  - b. Precautions to be taken vs. infection.
  - c. Special dangers of war wounds.
  - d. Measures to be taken to kill germs in wounds.

- e. Care of slight wounds and special directions for gunshot wounds.
  - f. General directions for dressing a wound.
  - g. Directions for applying the U. S. First Aid Packet.
4. Bleeding.
- a. Presence in every wound.
  - b. Kinds of bleeding and their separate characteristics.
  - c. Treatment of venous bleeding.
  - d. Treatment of arterial bleeding.
  - e.
    - 1—Necessity for keeping patient still
    - 2—Bleeding from a limb.
      - General treatment.
      - Manner of making tourniquet.
      - Length of time tourniquet may be left on.
    - 3—Bleeding from the head.
    - 4—Bleeding from the face.
    - 5—Bleeding from the neck.
    - 6—Bleeding from the chest and back.
    - 7—Bleeding from the stomach.
    - 8—Bleeding from the shoulder.
    - 9—Bleeding from the hip.
    - 10—Bleeding from the mouth.
    - 11—Bleeding from the nose.
    - 12—Vomiting of blood.
    - 13—Bleeding into a limb.
5. Wounds of joints.
- Special precautions and measures.
6. Internal bleeding.

## LESSON II. FRACTURES

1. A fracture is a broken bone. Conclusive evidence that a bone is broken is given by either of the following indications:
- (a) The injured limb is shorter than the other.
  - (b) A bend is seen in the limb where no joint exists.
  - (c) On gently moving the limb the two pieces of bone are felt to grate on one another.
2. Unless a doctor cannot be found for a considerable time, do not try to set the fracture. First aid treatment for fractures consists of immobilizing (that is, making non-movable) the limb affected by means of splints bandaged on above and below fracture. Splints may be made from pieces of wood,

a rifle, a bayonet and scabbard, newspaper rolls, and even a rolled blanket makes a good stiff splint; all splints must be padded. If no splints are available or when time is an important factor simply—in case of a leg—fix the broken limb to the sound one, and in case of the arm fix it to the chest, using in the former the sound limb and in the latter the chest to act as a splint. In bandaging on splints care should always be taken not to bandage immediately over fracture but above and below it. Don't bandage too tightly as during the first 24 hours considerable swelling of the part is likely to take place.

3. There are two kinds of fractures, simple and compound; a simple when there is no wound near; a compound when there is a wound leading down to the fracture. In the case of a compound fracture the wound must first be bandaged up and the fracture dealt with afterwards. When there is severe bleeding from the wound it may sometimes be dangerous to press on the wound and bandage it up tightly to stop the bleeding, for fear of making sharp pieces of bone injure important structures; it is better in such case to put a tourniquet around the limb between the wound and the body and tighten it up; or, if the wound is too near the shoulder or hip for this, to press on the artery supplying the part.

4. The following paragraphs will take up treatment for fractures in different parts of the body:

(a) Arm or Collar-bone.—If a bone of the arm or the collar-bone is injured, it will in most cases be sufficient to put the injured arm in a sling. This can be made (1) by taking a large square handkerchief and folding it across the middle to make a triangle half the size. One of the more pointed corners is then placed over the shoulder of the injured side, with the "square angle" under the injured elbow. The other pointed corner is then brought over the shoulder of the opposite side, and both pointed corners are then tied together behind the neck, care being taken not to pull up the elbow in so doing—the object being to support the forearm but not to raise it. (2) Or the sleeve can be pinned to the tunic with a safety-pin; or (3) if an overcoat is being worn the lower part of it on the injured side can be turned up over the forearm and fixed in a sling, a large handkerchief or belt tied loosely around the body and the elbow of the injured side will help to prevent further injury when the patient is moved. Nothing in the way of a splint is generally required in fractures of the upper limb, but where the forearm (or arm below the elbow) is much injured it may be supported on a bayonet scabbard and fixed to it by a couple of handkerchiefs, one on each side of the injury, before being put in the sling.

(b) Leg.—When a bone of the leg is thought to be broken it is best to turn the wounded man on his back, lay an unloaded rifle along the outer side of the injured limb with the butt-end in the arm-pit. The rifle is now fixed to the body, thigh,



and leg. To carry this out, a belt tied around the butt-end and the chest does very well, but must not be pulled too tight. Another belt around the rifle and hips, a little below the waist, should be strapped up as tightly as possible. Three other straps, handkerchiefs, bits of bandage or puttee, or even bits of strong string, are put around to fix the rifle to the middle of the thigh, the knee, and the ankle. A soldier with a broken thigh bone fixed up in this way was able to return to his own lines, a distance of three miles, by crawling slowly on his back by means of his elbows and the sound leg.

Where the leg is broken below the knee a couple of shorter splints, such as two bayonet sheaths, one each side, or two pieces of ration-box, are generally sufficient if a rifle cannot be obtained. Where no splints are available, tying the two legs together in three or four places does fairly well, provided that the uninjured one is kept quite straight. A bandage fixing both legs together or fixing a limb to a splint must never be put on so as to cover the wound.

(c) Wrist.—In putting one's hand out to save himself from a fall the wrist is often sprained and fairly frequently broken. When the bone is broken one part is commonly jammed into the other by the force of the fall (impacted fracture), and they are held fast. A broken wrist is therefore very like a sprained wrist; both are swollen, and though movement is painful, in neither case is the limb absolutely useless. As the two conditions are so much alike it is always wise to get the medical officer to look at any injury of the wrist.

(d) Thigh Bone.—In most cases it is quite easy to recognize when the thigh bone is broken. The limb is useless, it appears to be shorter than the other, and the foot is turned outwards so that it lies with the little-toe side on the ground. If the limb is moved grating will be felt. When the fracture is near the upper end, though the limb is useless, there is little shortening. And when, as happens fairly often when two pieces of bone are also jammed together and held fast (impacted), the limb can be moved and the person affected has even tried to walk. This is of course a very dangerous thing to do, because the two pieces of bone may become suddenly separated and the sharp end of one of them may cut its way into a large blood vessel or do other serious damage. It is therefore necessary to recognize a fracture of the thigh bone when the two pieces of bone are jammed together (impacted) and when they are not. We find the man lying with his foot turned out and we may first try very carefully to turn it in. If this can be done, but we feel a grating, we are dealing with an ordinary fracture. If the foot cannot be turned in without much force we have an impacted fracture. In all cases where a broken thigh bone is suspected, the injured limb is fixed to a rifle splint as previously described, or both limbs are tied together.



(e) Knee Cap.—When the knee cap is fractured the ordinary signs of a broken bone are absent. There is no unusual bending of the limb, it is no shorter than its fellow, and no grating is felt when moved. The limb can, however, only be moved with difficulty, and the patient is unable to walk. When the knee cap is broken right across, the two parts are pulled away from one another by the muscles, and a finger gently laid upon the knee cap feels a depression between the two pieces of bone. A long splint (e. g., rifle or piece of board from a ration-box) should be placed beneath or to the outside of the limb and fixed to it by handkerchiefs or bandages. The injured man should be kept lying down.

(f) Spine.—Injuries to the spine by blows, shell, or rifle-fire are always serious, and a person should not be moved until skilled help arrives unless this is absolutely necessary. While a man with a broken spine is being lifted on a stretcher it is desirable for someone to pull gently on his shoulders and a second person to pull against him by holding the patient's feet so as to straighten out the body and prevent overlapping of the spine and consequent injury to the spinal cord. Where such a thing can be obtained a shutter or door is even better than a stretcher for the removal of a patient with a broken spine, as it keeps him more rigid. If a man with an injury of the spine has to be moved a short distance to cover, and only one man is available, this can be carried out by clearing away all obstructions and then slowly pulling him by his shoulders, keeping the body as straight as possible all the time.

(g) Hip Bone.—A broken hip bone or haunch bone causes much the same symptoms as a broken spine (see above) and is nearly as serious. Great pain is produced when the injured man moves his legs or when the hip bone is pressed on. The soldier must not attempt to crawl or walk, but must be moved in the same way as one with a broken spine, except that there is no need to pull on the head and feet.

(h) Skull.—A broken skull does not often itself call for immediate treatment. When there is a scalp wound as well, and there is severe bleeding from it, it is better to stop bleeding by pressing on the arteries going to the part rather than on the wound itself.

When the lower part of the skull (base) is fractured, as may sometimes occur, from a blow on the top or side of the head, or a fall from a height, there is often bleeding from one or both ears, which may continue for hours. A piece of gauze from a first field dressing should be put over the bleeding ear and fixed loosely in position with a bandage, but no attempt must be made to stop the bleeding by tightly plugging the ear, as this may cause the blood to collect inside the skull and press on the brain.

(i) Lower Jaw.—When the lower jaw is broken, the teeth are

irregular and there is bleeding into the mouth. The wound, if there is one, should be dressed, and the jaw closed and supported by two pieces of bandage, each about a yard and a half long. One goes round the chin to the back of the neck, the other from below the chin to the top of the head. Each is tied loosely, and the four ends are tied tightly together.

5. Dislocations and Sprains.—There is no urgency about the treatment of dislocations and sprains. As there are no sharp pieces of bone to cause further injury it is sufficient to allow the limb to remain in any position that is comfortable to the patient. If it ever gets moved in reaching cover or going to the dressing station great pain may be produced, but very little damage will occur. To lessen the pain use a sling for the arm and fix the leg to a rifle along the outer side, or tie both legs and thighs together with several handkerchiefs or bandages. It is useful to remember that while fractures may take place anywhere in a limb, dislocations and sprains can only occur at joints.

6. If it is known that a doctor cannot be reached for a considerable time, an attempt should be made to set fractures before putting on splints, particularly if it is the leg, by gently pulling the broken limb out straight after cutting off clothing. Keep swelling down with hot water.

#### OUTLINE

1. Evidences of fracture.
2. First aid treatment in general—splints.
3. Special treatment for compound fractures.
4. Special treatment for fractures in different parts of the body.
  - a. Arm or collar-bone.
  - b. Leg.
  - c. Wrist.
  - d. Thigh-bone.
  - e. Knee-cap.
  - f. Spine.
  - g. Hip-bone.
  - h. Skull.
  - i. Lower jaw.
5. Dislocations and sprains.
6. Directions for setting fractures.

LESSON III. Artificial Respiration from Drowning, Suffocation. Burns and Scalds.

1. Recovery of drowning persons.

Immediately on removal from the water, without stopping to remove clothing, artificial respiration should be commenced on a

person apparently drowned. The Schafer method of artificial respiration is the approved one and is as follows:

Lift patient up by the middle of body to allow any water and foreign matter that will run out readily, to do so. Clear the mouth and pull tongue forward. Loosen the tunic and belt. Turn the patient face downward on the ground with the legs straight, one arm to the side and the other bent above the head so that the forehead rests on the forearm. This prevents the mouth and nose from being stopped up by resting on the ground. Next place a folded coat beneath the pit of the stomach, put yourself astride or on one side of the patient's body, in a kneeling or squatting position, facing his head. Placing your hands flat on the small of his back, with the thumbs parallel and touching, and the fingers spread out over the lowest ribs, lean forward with the arms straight and steadily allow the weight of your body to fall on the wrists, and so produce a firm, even, downward, upward, and forward pressure, which must not be violent, on the loins and the lower part of the back. This part of the operation should occupy the time necessary to count, slowly, one, two, three. By this means the air (and water, if there be any) is driven out of the patient's lungs. Water and slime from the air passages may also run out. Immediately after making the downward pressure swing backward rather suddenly so as to relax the pressure and allow air to enter the lungs. Do not lift the hands from the patient's body. Count two and then exert the pressure again. Repeat this forward and backward movement (pressure and relaxation of pressure) 12 or 15 times a minute, without any marked pause between the movements. Whilst the operator is carrying out artificial respiration others may, if there be opportunity, busy themselves with applying hot flannels, hot bottles, etc., between the thighs and to the arm pits and feet, or promote circulation by friction, but no attempt should be made to remove wet clothing or give restoratives by the mouth till natural breathing has recommenced. When this has taken place, allow the patient, to lie on the right side and apply friction over the surface of the body by using handkerchiefs, flannels, etc., rubbing legs, arms, and body all toward the heart, and continue after the patient has been wrapped in blankets or dry clothing. As soon as possible after complete recovery of respiration remove patient to nearest shelter. On respiration and if power of swallowing has returned, small quantities of warm coffee, tea, milk, wine, etc., may be given. Encourage patient to sleep, but watch carefully for some time, and allow free circulation of air around patient.

NOTE.—Artificial respiration must also be resorted to in case of suffocation by charcoal fumes or coal gas, mining accidents, hanging, lightning stroke, and severe electric shock.

## 2. Suffocation.

In modern warfare suffocation is most apt to be produced by (a) through the filling in of a trench or explosion of a mine, or



(b) by the use of poisonous gases. Effective measures against the latter are taken up in the special gas defense work. This paragraph will cover treatment for the former case.

If you watch a man lying asleep who is breathing deeply you will notice that the chest and stomach rise with every breath that is taken. When we breathe the chest is made bigger by the action of the muscles, and air is drawn in to fill up the otherwise vacant space. As chest enlarges downward the stomach is pressed on, and therefore bulges in front. If the chest and stomach cannot expand no air can be drawn in; that is to say, we cannot breathe, and so must die. Therefore, if a trench falls in, and you cannot get out, try to press out with your elbows to keep the pressure of the soil from your chest and stomach. Also in digging out any one partially buried, get the chest and stomach free first and never mind about the limbs till later. If now the man does not begin to breathe, his mouth must be cleared of dirt with the fingers and his tongue seized and pulled out sharply two or three times. If this does not make him breathe, ARTIFICIAL RESPIRATION should be at once started.

### 3. Burns and Scalds.

Treatment for these must be immediately undertaken as patient is in danger of death from shock—the first thing to do is to give the patient rest and warmth by means of blankets and hot water bottles or by immersion in a warm bath. Then, when the warmth of the body is thoroughly restored, attention should be directed to the local conditions, being careful to expose for this purpose only one limb at a time.

If clothing sticks to the burn, do not try to remove it, but cut around it. Prick blisters at both ends with a perfectly clean needle, and remove the water by gentle pressure, being careful not to break the skin. Dressings of simplest aseptic or non-irritating anti-septic oils, ointment, or vaseline, spread on muslin or similar light material, should be applied and covered with absorbent wool and bandage. A good application for a burn is carbolic acid dissolved in water (a teaspoonful in a pint of water) or tincture of iodine dissolved in water (one teaspoonful in a pint of water, to which is added as much salt as will cover a dime). Lacking these remedies ordinary, baking soda or flour may be dusted on the unbroken skin, or a cloth dampened in salt water that has been boiled. The ointment known as "Unguentine" is effective.

Slight burns may be immediately treated with applications without taking measures against shock. Slices of potatoes can be applied to a burn with advantage, if burn is slight.

Treat sunburn with olive oil, vaseline, or butter, or with glycerine or witchhazel applying with a dampened cloth.

Treat quick lime or lye burns with vinegar, carbolic acid burns with alcohol, burns from other acids with baking powder or lime water.



Burns are liable to be met with in present war from flame throwers. As a measure of prevention against this remember that flame travels upward when force lost and if you lie or bend down you are much less likely to be injured.

#### OUTLINE

1. Recovery of drowning persons.
  - a. Immediate resort to artificial respiration.
  - b. Schafer method of artificial respiration.
    1. Preliminary action.
    1. Position of rescuers body and hands.
    3. Movement.
    4. Action following restoration of breathing.
  - c. Other cases in which artificial respiration should be used.
2. Suffocation.
  - a. Conditions in present war under which it is likely to be met.
  - b. Treatment.
3. Burns and Scalds.
  - a. Prevention of shock.
  - b. Cutting of clothing.
  - c. Pricking of blisters.
  - d. Applications.
  - e. Treatment of slight burns.
  - f. Treatment of sunburn and acid burns.
  - g. Conditions under which they are likely to be met in present war, and preventative measures against them.

#### LESSON IV

#### Unconsciousness. Signs of Death. Choking. Treatment of Gassed Cases

1. Unconsciousness may result from a number of different causes, to none of which the same treatment apply.

a. Unconsciousness may result from concussion or stunning. The man will usually seem to be deeply asleep and will generally look pale and be breathing quietly. He may remain in this condition for many hours, or the unconsciousness may only last a moment or so and the person feel all right or only a little dazed after it. While the unconsciousness lasts the patient should be covered up and kept as warm as possible; he should be lying down, and on no account should anything be given him to drink. When he comes to himself—even though the stunning may have only lasted for a moment—as complete rest as possible for some

hours, and the avoidance of stimulants of all kinds are essential, for the following reasons. The blow or fall which causes the unconsciousness not infrequently also injures some small blood vessel in, or on the surface of the brain. If the man remains quiet, but little blood may be poured out from the injured blood vessel—enough only perhaps to give rise to a slight headache—but movement or alcohol or tea or coffee may stimulate the heart to drive the blood more forcibly around the body, and sufficient may be shed to produce a return of unconsciousness or even death from pressure on the brain by blood which the firm resisting walls of the skull prevent from escaping. Hence we have the rule of complete rest, warmth, and no stimulants during the unconsciousness that results from stunning and for some hours after, and it is a rule that applies to unconsciousness from many other causes as well.

b. Unconsciousness from Shock from Accident or Loss of Blood.—Any severe injury is, as a rule, accompanied by a condition of weakness called shock. The condition generally lasts for several hours, and the person affected may or may not be unconscious. Although looking pale and feeling far too weak to move, he may know all that is going on. The most important thing in the treatment of shock is to warm the sufferer and to keep his head low, so that there may be an abundant supply of blood for the brain. Therefore lay the patient down—and it is better to put him on his side if this can be managed—and cover him up with extra clothing that you can get hold of. Any wound or bleeding will of course be dealt with, and when the patient has recovered consciousness and can speak he can be given a little cold water to drink if he is thirsty, and, provided all bleeding has stopped and there is no injury to the head a little hot soup or other stimulant will do no harm. If there are wounds or bleeding, always deal with these first.

c. Fainting—In fainting there is always unconsciousness; the condition differs from shock in that a fainting fit only lasts a few minutes, while shock lasts for hours. Bleeding, pain, and fright, and many other conditions will make a person faint, the essential cause in all of these being a deficient quantity of blood going to the brain. The proper treatment therefore follows at once; increase the blood supply of the brain, by lowering the head between the knees if a patient looks or feels faint (telling him what you are doing), or by sipping cold water, which stimulates the heart. If man has already fainted, lay him on his back with his head low, so that blood can run back to it, loosen clothing, allow plenty of fresh air.

d. Heat Exhaustion.—When in this state, a person is pale and in a cold sweat, and needs stimulation if possible, because it is a condition of weakened energy. If nothing is obtainable give patient rest with loosened clothing.

e. Heat, Stroke.—This is just opposite from heat exhaustion and is an indication of over stimulation, so under no circum-

stances give stimulants for this. The indications of this condition are flushed, dry, hot skin. The coldest water possible doused all over the body to take up its heat is the best thing for it. Be sure patient has plenty of fresh air, is removed to cool place, and have clothing removed from neck and upper part of body. Sometimes there is no water obtainable along the road, and the water from a comrade's canteen must be used; in this case use it sparingly and sprinkle the water evenly all over.

f. Fits.—Lay patient on his back with the head slightly raised. Loosen the clothing about the neck and chest and prevent him from biting his tongue by placing the handle of a tooth brush, or stick, or a cork, or similar article, as a gag, between his teeth. Employ sufficient restraint only to prevent him injuring himself; don't try to hold him down on the floor or make him sit up, he will come to no harm on the floor and you cannot stop the fit. Ammonia on a handkerchief held under the nose to smell will assist reviving consciousness. Do not give stimulants. He will come to in time. Put him in the hospital at once if possible.

2. Signs of death.—(a) Respiration ceased: May be tested by applying mirror to lips or feather to mouth, or by the movement or otherwise of a glass of water on abdomen.

(b) Circulation ceased: No pulse at wrist, heartbeat not felt or heard.

(c) Face: Fixed sculptural expression.

(d) Condition of eyes: Loss of transparency and of elasticity of eyeball.

(e) Pallor of skin: Doughy, inelastic feel.

(f) Discoloration of skin on dependent parts after a time.

(g) Muscles are flabby immediately after death but rigid afterwards (rigor mortis).

(h) Decomposition setting in is an absolute sign of death. Green color of the abdomen is the first indication.

Interval of time after death:

(a) If body is rigid, death probably has occurred longer than 3 hours.

(b) If there are discolored patches on dependent parts, longer than 8 hours.

(c) If putrefaction has set in, longer than 12 hours.

(d) If rigidity has passed off, longer than 16 hours.

3. Choking.—The common practice of slapping the back often helps the act of coughing to dislodge foreign bodies in the wind-pipe. If this does not succeed, have the patient lie over a chair with his head down low or hold him as in the first step to revive a drowning person and have him cough. When in either of these positions have some one slap him on the back so as to induce coughing.

The above failing, give him a large amount of warm water with a little salt, mustard or baking soda in it, and then have him put his finger in his throat so as to induce vomiting which will often bring up the obstruction.

In children, and even in adults, the expulsion of the body may be facilitated by lifting a patient up by the heels and slapping his back in this position.

If none of the methods above named are successful, summon a physician, taking care to send him information as to the character of the accident, so that he may bring with him the instruments needed for removing the obstruction.

4. Treatment of Gassed Cases.—A man may be slightly gassed and apparently in no danger, but later turn out to be seriously affected. The first aid treatment should therefore be resorted to in all cases.

Rest is the most important point of all in the treatment of gassed cases; any exertion brought about by work or by shouting orders makes a man breathe the gas deeper into his lungs. The first thing to do, then, is to let a man lie down; if in a trench and there is not time to put him in a dugout, roll him over the back of the parados, or at least put him on the firing step. In laying him down lay him on his side so that the valve of his mask may function properly.

The patient should be kept warm, especially at first, and be allowed the fullest possible amount of fresh air. Every impediment to the easiest breathing should be removed. Belts, suspenders, the blouse, etc., should be loosened. The clothing should be removed in the first dressing station where new wraps can be procured. Patients should be carried to the dressing station, and not allowed to walk there.

Ammonia is not desirable for use and in many cases will only aggravate the effects of the gas. Drugs are not desirable either; at first a great deal of morphine was used in gassed cases, but its use is now prohibited because of the drug habituates made as a result of its administration for this purpose. The steam of stimulants is now used, and blood letting is also in vogue.

#### OUTLINE

##### 1. Unconsciousness.

- a. Unconsciousness from concussion or stunning.
- b. Unconsciousness from shock from accident or loss of blood.
- c. Fainting.
- d. Heat exhaustion.
- e. Heat stroke.
- f. Fits.



2. Signs of death.
  - a. Signs merely to indicate death.
  - b. Signs indicating interval since death.
3. Choking.
4. Treatment of gassed cases.
  - a. Rest.
  - b. Warmth, fresh air, and easy breathing.
  - c. Treatment in dressing station.

## LESSON V

### **Frost Bite. Foot Troubles. Blisters. Bruises and Sprains.**

1. Frost bite and numbness occurs most frequently when there is lack of food and sleep, when a man has been continually wearing wet socks, shoes, leggins, mittens, etc. Frozen feet are brought about much more rapidly when the circulation of the blood in the feet and legs is interfered with by the wearing of tight shoes, tight leggins, or the wearing of anything causing constriction of the lower limbs.

Frost bite may be prevented by movement, for the circulation is then increased. Therefore a man, even on sentry duty, should keep moving about and not stand still.

To prevent it, also, the following measures should be taken: feet and legs to be washed and dried before going out on duty: all those parts which are most susceptible to frost bite (fingers, toes, ears and nose—because blood is slowest in those places) should be well rubbed with whale oil or anti-frost bite grease, which should not be merely applied, but be thoroughly rubbed in until the skin is dry, to be of value; when feet rubbed, a pair of dry socks to be put on them; hot food to be provided as much as possible; after getting wet, feet to be dried as soon as possible and dry socks put on. Each man should carry an extra pair of dry socks with him. Drinking alcohol gives temporary warmth but its after effects are to lower the temperature of the body.

The first symptoms of frost bite are generally cold in the part, then pain, then loss of sensation. Its appearance is a marble whiteness on the skin.

If any of these symptoms are present, it is bad to warm the part before a fire, instead rub it briskly with snow, or a dry glove, or a cloth steeped in ice cold water and wrung dry. If it has been frozen more than fifteen minutes, rub very gently with snow, cold water, or coal oil (kerosene), lest the flesh be broken.

Returning pinkness is a sign of thawing; if the symptoms continue, the part will become swollen and change color, which means gangrene. In that case if possible a surgeon should be seen at once, if not, treat as a burn. When thawed out, dry well and smear with grease.

2. Freezing.—If a comrade falls down unconscious from the cold, he must not have warm wraps put over him or be kept near the fire; on the contrary he should be taken into a cold room without draughts, and surgeon should be searched for. While waiting, loosen clothing and rub arms and legs toward the heart with a cloth soaked in cold water or snow and wrung dry, using pressure, and artificial respiration should be performed in all cases.

When consciousness has returned give him hot drinks, cover him up in warm clothes and let him remain quiet. Put him in the hospital if possible.

When freezing to death a man feels overcome with sleepiness and stupor. Take a switch or stick and beat him unmercifully, for falling asleep means death.

3. Sore feet.—New or ill fitting shoes are liable to cause blisters, and these, if not attended to may easily become poisoned. Even with perfect fitting shoes, dirty socks or dirty feet may easily cause soreness. The feet should therefore be washed frequently and socks washed whenever they can be dried, and kept well darned. Socks which are too large or too small or form folds inside the shoes are also liable to make the feet sore.

4. Boils.—They are very painful, and a great nuisance when on active service. To avoid them, (a) Never neglect an opportunity of a good wash all over with soap and water, especially if you can get hot water (b) Keep the bowels well open every day, and do not mind asking the Medical Officer for a pill if you miss a day or feel you need one. (c) Do not eat too much meat. Eat vegetables and fruit whenever you can get them.

5. Bruises.—The best treatment for a bruise is heat.

A hot brick or a bottle of hot water wrapped in cloth, towels wrung out of hot water, or even an electric light bulb, will give much relief.

However, always remember this: Never put the hot object on the bare skin—always wrap the source of heat in a thick cloth to hold the heat in and at the same time protect the skin. If not practicable to do this wrap the source of heat, then spread a towel over the skin before applying the hot object.

If you use an electric bulb, watch it closely, as it will char and possibly set things on fire.

The above treatment is also excellent for lumbago, stiff neck, and stiff muscles.

A tub bath as hot as you can stand it is fine for refreshing tired, stiff muscles. It is also good for lumbago.

6. Blisters.—The cause of blisters should be inquired into with a view to preventing further injury. Blisters may be pricked with a needle sterilized by being held in the flame of a match for a few seconds, or left in boiling water for some minutes. When the fluid has escaped, the blisters should be dusted over

with absorbent powder, such as boric powder or oxide of zinc—preferably the latter. To protect the blistered part in subsequent marching, a dressing of antiseptic cotton wool, kept in position with adhesive plaster, may be used. In this case care must be taken at the end of the march to remove the dressing and if necessary, continue treatment. Blistered feet must be kept scrupulously clean.

7. Sprains.—The regular medical treatment is to plunge a sprained ankle, wrist or finger, into water as hot as can be borne at the start, and to raise the heat gradually thereafter to the limit of endurance. Continue for half an hour, then put the joint in a hot wet bandage, reheat from time to time, and support the limb in an elevated position—the leg on a chair or stool; the arm carried in a sling. In a day or two begin gently moving and kneading the joint, and rub with liniment, oil or vaseline.

As a soothing application for sprains, bruises, etc., the virtues of witch hazel are well known.

#### OUTLINE

1. Frost bite.
  - a. Conditions and causes.
  - b. Prevention.
  - c. Symptoms.
  - d. Treatment at first.
  - e. Treatment after thawing.
2. Complete freezing.
3. Sore feet.
4. Blisters.
5. Bruises.
6. Boils
7. Sprains.

### LESSON VI

#### Bites, Poisons, Infectious Diseases, Bowel Complaints

1. Snake or dog bite.—Either requires immediate and heroic treatment. **LOSE NO TIME.**

a. Prevent the poison from traveling toward the heart and brain by putting on at once a tourniquet between the wound and the heart.

b. Suck the wound and be sure to spit out the poison and rinse the mouth afterward. It is safe, if you have no cuts or sores on the lips or in the mouth.

c. Enlarge the wound with a knife (in the direction of the bone, not across) to make it bleed more freely, and again suck the wound,

d. Apply to the wound any strong acid or caustic, such as carbolic acid, lime, wood ashes or tincture of iodine, or burn it with a hot iron. Telegraph wire will do.

e. Wash out the wound with hot water and pack with equal parts of baking soda and salt, and apply a bandage.

f. Then, in the case of a snake bite, loosen the tourniquet little by little, taking about half an hour, so as to permit any poison that may remain in the wound to be gradually absorbed by the blood. In the case of a dog bite, the tourniquet is loosened at once.

After the tourniquet has been removed, the patient must rest quietly for several hours. If he feels faint, he may have a stimulant—alcohol, coffee or tea—but do not give the stimulant before the poison has been removed from the wound, because stimulants increase the heart beats and thereby hurry the poison into the blood.

If the dog is not mad (rabid), the wound does not need treatment different from any other kind of a wound.

When bitten by a snake, kill it, if possible, and have it shown to a doctor for examination.

2. Poisoning.—(a) Corrosive: Causes—such acids as vitriol, cresol, carbolic acid; or alkalis, as caustic soda, strong ammonia.

Symptoms—great pain, immediately after poison has been swallowed in mouth and throat, which look as if scalded. Lips stained and blistered. Shock, difficulty of breathing, and breath smells sour.

Treatment—do not give emetics. Give, for acids, whitening, chalk, wall plaster, or washing soda, mixed with water; for alkalis, weak vinegar or lime juice. Milk and raw eggs good in either case.

If it is known patient has taken carbolic acid, pure alcohol, or gin or whiskey in large quantities is very desirable and will neutralize the acid.

In the case of bichloride of mercury, give the patient the whites of four or five eggs or some milk into which raw flour or corn starch has been stirred, and give one-half glass of weak lime water.

(b) Irritant: Cause—decomposed food (ptomaine), arsenic, mercury, phosphorus.

Symptoms—inflammation and pain in stomach, vomiting, etc.

Treatment—emetics, (a tablespoonful of mustard or salt, in tumbler of water), warm water to wash out; then milk and eggs.

(c) Systemic: Cause—opium, narcotics, strychnine, prussic acid.

Symptoms—action on nerves and brain, heart failure, drowsiness, difficulty in breathing.

Treatment—emetics, (a tablespoonful of mustard or salt, in



tumbler of water), then stimulants (hot coffee, weak alcohol). If narcotics suspected, walk patient about.

3. Stings.—Stings of bees, jelly fish, and other stinging animals are treated with a very weak solution of ammonia in water applied as a lotion. Or apply a very weak solution of carbolic acid in water, a strong solution of baking powder, a slice of crushed raw onion, a moist quid of tobacco, witch hazel, listerine, or a paste of clay.

Before applying any of these remedies, extract the sting, if left in the wound. Also, work out as much of the poison as possible by massaging and sucking the wound.

In the case of spider bite, apply a cloth dampened with alcohol or weak ammonia and water.

4. Infectious Diseases.—Isolate the patient, segregate the people who have been in contact with him. Do not forget to make arrangements about their food and water. Before disinfection is carried out, and in order to prevent the clothes, etc., being taken away, placing a seal on the door is a very useful practice. All useless and dirty kit should be burned.

5. Diarrhoea.—Apply warm bandages to the belly. Some woodsmen recommend the following: Fire brown a little flour to which two teaspoonfuls of vinegar and one teaspoonful of salt are added; mix and drink. They claim this is a sure cure nine cases out of ten. A tablespoonful of warm vinegar and a teaspoonful of salt will cure most severe cases. Also, hot ginger ale or hot water containing a teaspoonful of witch hazel is good. Repeat any of the above drinks about every hour.

Take a purgative, which will usually expel the offending cause, generally too much undigested food.

6. Headache.—Among troops headache is usually due to intestinal indigestion, combined with a congestion of the stomach. Take a tablespoonful of Worcestershire sauce or 5 drops of tabasco sauce in a tumbler of hot water as a drink and put a small piece of soap up into the bowel to cause a movement.

Aspirin tablets and other preparations are effective in dispelling headaches.

#### OUTLINE

1. Snake or dog bite.
  - a. Application of tourniquet.
  - b. Drawing out poison.
  - c. Cauterization.
  - d. Loosening of tourniquet.
  - e. Subsequent treatment.
2. Poisoning.
  - a. Corrosive.
  - b. Irritant.
  - c. Systemic.

3. Stings.
4. Infectious Diseases.
5. Diarrhoea.
6. Headaches.

## LESSON VII

### Miscellaneous Ailments, General Suggestions

1. Earache.—Put a teaspoonful of salt into a quart of water and add 6 teaspoonfuls of tea. Boil it. As soon as it is cool enough to stand the finger, drip some into the nostrils until it falls into the throat. Clear out the nose and throat by sniffing—do not blow the nose—and then gargle with the rest of the remedy as hot as can be taken, holding each mouthful well back in the throat. This will often open up the tubes running from the ears to the throat, and relieve the pressure against the ear drum. In addition, a little hot oil may be dropped into the ear. Repeat the treatment in one-half an hour if not successful first time.

2. Ear, foreign body in.—Lay the head over, with the affected ear up, and pour in some warm oil or soap suds. This will float the thing up, unless it be a vegetable such as a grain of corn or a bean. Turning the affected ear down and then jumping, jerking the head, or pounding it gently, may dislodge it.

A little peroxide of hydrogen poured into the ear will often dislodge the substance, especially if it be wax.

In case of an insect, a bright light held near the ear will often cause it to leave the ear to go to the light.

3. Eye, foreign body in.—Close the eye for a few moments and allow the tears to fill the eye; upon opening it, the body may be washed out by them. Never rub the eye. The foreign body can often be removed by keeping the eye open with one hand and splashing water into it with the other, or by dipping the eye into clean water while holding the eyelid open with the hand.

If the body lies under the lower lid, make the patient look up, and at the same time press down upon the lid; the inner surface of the lid will be exposed, and the foreign body may be brushed off with the corner of a handkerchief.

If the body lies under lid, (1) grasp the lashes of the upper lid and pull it down over the lower, which should at the same time, with the other hand, be pushed up under the upper. Upon repeating this two or three times, the foreign body will often be brushed out on the lower lid. (2) If this fails, the upper lid should be turned up; make the patient shut his eye and look down; then with a pencil or some similar article press gently upon the lid at about the middle, and grasping the lashes with the other hand, turn the lid up over the pencil, when its inner surface will be seen, and the foreign body may readily be brushed off.

If the body is firmly stuck in the surface of the eye, a careful attempt may be made to lift it out with the point of a needle. If not at once successful, do not try again, as you may injure the sight.

Lime, plaster or whitewash in the eye should be washed out with a very weak mixture of vinegar and water. Acids in the eye may be washed with baking soda in water. Olive oil will also afford relief.

After the removal of a foreign body from the eye, a sensation as if of its presence often remains. People not infrequently complain of a foreign body when it has already been removed by natural means. Sometimes the body has excited a little irritation, which feels like a foreign body. If this sensation remains over night, the eye needs attention, and a surgeon should be consulted; for, it should have passed away, if no irritating body is present.

After the removal of an irritating foreign body from the eye, salt water should be poured into it, then butter, lard or olive oil, may be used for a salve.

4. Nose, foreign body in.—If it cannot be sneezed out, lean the head back and pour a little oil into the nostril. Then sniff and blow the nose alternately. If this is not successful, take a lead pencil and try to push the object straight back into the throat. This must be done very gently.

5. Snow or sun blindness.—Smear the nose and face about the eyes with charcoal, and wear a cloth over the face with small holes for the eyes.

6. Body-Lice.—Body-lice are often a great nuisance on active service, and are liable to become of serious importance at any time, because it is believed that, in certain outbreaks of serious illness, it is lice that convey the disease from one individual to another. The body-lice live in the underclothing, especially in the neighborhood of the seams, and lay their eggs there. Body-lice are but rarely seen on the skin. It follows, therefore, that if a person troubled with these creatures takes a bath and puts on clean clothes he will be quite free from them. To free the underclothing, it should be boiled, or if this is impossible, ironed all over both sides with a hot flatiron. It is said that wearing a bag of powdered sulphur next the skin is a useful preventative of lice.

7. Chiggers.—Apply kerosene oil. Bacon is also excellent, and so is butter or lard with salt.

8. General suggestions for an ever-ready packet.—It is suggested that you take with you in your pack or pocket the following articles, which will not materially add to the weight of your equipment, and may prove of value to you.

(1) Several clean handkerchiefs. These are very useful for bandaging a wound or fixing on splints.

(2) A dozen large safety-pins are of use in making slings or fixing together torn clothing.

(3) Some pieces of stout string.

(4) A small roll of one-inch rubber adhesive plaster. Put a piece of this round a cut or scratched finger at once, before the dirt gets in. The plaster is also very useful for mending holes in ground sheets and mackintoshes.

(5) A box of rhubarb pills for constipation.

(6) A small bottle of five-grain tablets of aspirin, or, to give it its full name, aceto-salicylic acid. Take two every three or four hours to relieve headache, toothache, or the pain of any slight injury. They are quite harmless unless taken more often than here advised.

(7) A small tin of equal parts of powdered boric acid and starch is useful for the feet and for soreness in the crutch.

Moss, "Manual of Military Training," Part V., Chapters I and II, are most valuable on Care of the Health and Personal Hygiene.

## LESSON VIII

### On Moving Injured Persons

1. One soldier can assist in the removal of another who has been injured in the following ways.

(a) The Human Crutch.—Get the injured person to stand up. Then stand beside him and put your arm nearest to him around his waist. Tell him to put his arm around your neck and hold it with your other hand. You can then help him to walk and support him if he is faint. The method is suitable for any injury of the arm or foot, but not for a broken leg. Stand on the same side as the injured foot, but on the opposite side to an injured arm.

Should the injured man become too weak to walk, remove your arm from around his waist and move in front of him, keeping his arm over your shoulder and holding it in this position. Now bend your knees a little and as you rise bend forward, and thus get the injured man on your back like a sack of flour. The arm that went round his waist can now be brought behind him to steady him. in this way an injured person can be carried quite well for a short distance.

(b) In the Arms.—When the patient is not very heavy he can be carried like a baby, one of your arms under his knees, the other around his waist, and one of his arms around your neck. But where the injured man is unable to stand it is almost impossible to raise him from the ground to carry him in this way without help from some one else.

(c) Pick-a-Back.—Kneel down while he gets on your back, and tell him to hold on by your tunic and not to put his arms around



your neck to choke you. As he has to hold on himself, one arm at least must be uninjured.

(d) The Fireman's Lift is especially useful for carrying an unconscious patient or where the ground is rough and difficult. Roll the man on to his face and put his arms to his sides. Kneel at his head, pass your hands beneath his armpits and pull him upwards towards you. Move your hands down him till they are at the level of his waist, and locking them together behind him rise to a standing position. Suddenly drop down on to your left knee, while seizing his left wrist with your right hand, so that his body falls across your left shoulder. Put your left hand round both thighs and seize hold of his left hand. Rise to the standing position and adjust his weight on your left shoulder. This is by far the best method of carrying a heavy unconscious patient. Over rough ground it is very useful to have the right hand free.

(e) By pulling along on the ground.—Though never desirable, it is sometimes necessary (if you can get no help) to pull an injured man along the ground to get him to cover. First remove obstructions and then pull him head first by holding on to his tunic. Or pass a puttee behind his back and under each armpit, and pull him along by this; or even tie both ends to your belt and pull him in this way as you crawl along. If a leg or thigh is broken, first apply a splint; or, if not obtainable, tie both legs and thighs together.

2. Where there are TWO people to assist in removing an injured man.

(a) A Temporary Trench Stretcher can be made of a tunic and two rifles. Turn the sleeves of your tunic inside out as you take it off and button it up. Pass an unloaded rifle down each arm-hole. The injured man sits in the tunic with his back resting against that of the first bearer. The whole thing is made much safer by putting a couple of belts round the tunic and rifles, buckles underneath. The method is suitable for most injuries where patient is conscious and able to sit up. It can be used for a broken leg, but not for a broken thigh.

(b) The Fore-and-aft Carry.—The injured man sits on the ground with his legs a little separated from one another. One bearer stands behind him, and bending down passes his arms round the wounded man's chest below the armpits and locks his fingers in front. The other bearer stands between the patient's knees, and bending down catches hold of them. Both then rise together. The method is suitable for many not very severe injuries. Patients can be very quickly picked up and carried to cover by it, but as the rear bearer is doing most of the work it is very tiring for him.

(c) The Two-Hand Seat.—The patient sits on the ground with the knees bent up. The bearers stand facing one another on each side of him, and each passes a hand beneath his buttocks,

hooking their fingers together beneath him. A back is made by one hand on the opposite shoulder and the other on the opposite hip. If the patient can use his arms he passes them round the bearers' necks. This is a great assistance to the bearers, although it is not absolutely necessary, as a back is provided by the bearers' arms. The method is only suitable for short distances.

(d) The Four-Hand-Seat.—As there is no back provided in this method the wounded man must have at least one arm free to put round a bearer's neck and hold on by. Each bearer seizes his left wrist with his right hand as they face one another; the hands are joined and form a square. On this the patient sits. Or if he is unable to rise from the ground he raises himself a little by his hands, while the bearers' hands, after being joined above him for practice, are locked beneath him. This method is much less tiring for the hands than the two-hand seat. But since the bearers have to take side steps, they are in both methods compelled to travel slowly.

(e) The Rifle Seat.—The bearers stand side by side facing the same direction. They each take hold of opposite ends of an unloaded rifle, which they hold in front of them by both hands. On the middle of this is placed a folded tunic if time permits, and on this the patient sits with his arms around the necks of the bearers. As the bearers are facing the direction in which they are advancing they can walk easily, or even run.

(f) The Human Stretcher.—The bearers stand one on each side of the wounded man facing him. Each half closes his left hand, and passing it beneath the upper part of the thighs of the wounded man they lock their fingers together. The right hands support the shoulders and legs respectively. A patient can be carried a short distance by this method. It is the most convenient method of loading a stretcher where there are only two bearers.

3. With more than two helpers it is much easier to move a wounded man.

(a) By means of the Clothing.—Three bearers kneel on each side of the patient. His tunic is unbuttoned and rolled up on each side. One bearer on each side takes hold of the rolled up tunic at the level of the shoulders and places the other hand beneath the head. The middle bearer on each side catches hold of the rolled up tunic at the level of the waist, and with the other hand takes a good grip of the trousers at the side of the buttocks. The last two bearers support the thighs and legs by locking their fingers beneath them. When every one is ready all rise together slowly and move off by taking short side steps. A very severely wounded man can be raised in this way a few inches and a stretcher passed beneath him. Where the spine is injured two extra bearers gently pull on the head and feet to keep the spine straight while the patient is being raised

for the stretcher or shutter to be pushed beneath him. With slight modifications this method can also be used when four bearers only are available.

(b) The Blanket Stretcher.—A very useful stretcher can be made from a blanket, rug, or mackintosh ground sheet and two rifles or poles. The blanket is first placed beneath the patient. If he is severely injured this is best done by rolling up the blanket from one end and then placing it beneath the head as a pillow and gradually unrolling it from above, gently raising the patient a little bit at a time as the blanket is unrolled beneath him. A rifle is then placed on the edge of the blanket on each side of the wounded man and rolled up in the blanket until each rifle (covered by blanket) touches the patient. Two bearers take up their places on each side of the patient and lift him by means of the blanket-covered rifles while two others raise his legs. The bearers pull against one another to keep the blankets tense and move off by short side steps, crossing their feet as they walk. Or the patient lying on a mackintosh sheet can be readily carried by bringing together the two sides of the sheet and lashing them to a long pole by ropes passed through the eyelet holes.

#### OUTLINE

1. One-man methods.
  - a. The Human Crutch.
  - b. In the arms.
  - c. Pick a-back.
  - d. The Fireman's lift.
2. Two-man methods.
  - a. Temporary Trench Stretcher.
  - b. The fore-and-aft carry.
  - c. The two hand seat.
  - d. The four hand seat.
  - e. The rifle seat.
  - f. The human stretcher.
3. Methods with more than two helpers.
  - a. By use of the clothing.
  - b. The blanket stretcher.

### Part 9

## ANTI-GAS INSTRUCTION

In the present war instruction in gas defence is an essential feature of the training of every man, as the first step in giving this instruction to the Supply Train, a Train Gas Officer should be designated. In this cantonment a special training was given

to such officers for a period of about two weeks, after which time he gave two hours per week of gas defense drill and instruction to each company according to the following schedule, taking up two sections per week.

### OFFICE OF DIVISION SCHOOL

#### *Schedule for Training of Enlisted Men.*

(For guidance of battalion anti-gas officers.)

*Seven weeks training.*

*Two separate hours per week.*

1. *Introduction.* Methods of attack. Effects of Gas.

Seriousness of this form of warfare.

2. (Issue of respirators, roughly according to size.)

*Protection.* S. B. R. Description. Method of working.

Inspection.

3. Inspection of S. B. R.

Visit to Lachrymatory. Chamber for fitting.

4. *Drills.*

Breathing.

Necessity for holding breath.

Exercises in holding breath.

Respirators.

Adjustment by numbers.

Clearing masks.

Smelling of gas.

Removal of masks.

5. *Drills.* (Continued.)

Exercises in holding breath.

Adjustment by numbers and without.

Cleaning eyepieces.

Speed drills.

6. *Drills.* (Continued.)

Exercises in holding breath.

Speed drill and tests.

Giving and passing on orders.

March and shoot double time march in respirators.

7. *Drills.* (Continued.)

Exercises in holding breath  $\frac{1}{2}$  hour.

Speed in adjustment.

*Lecture.* Gas alert. (Wind Dangerous.) Measures taken.  
 $\frac{1}{2}$  hour.



8. *Lecture.* Gas shells. Giving alarms, etc.
9. *Drill for gas shells.*  
Holding breath.  
Adjustment from slung position.  
Gas shell demonstration.
10. *Drill.* Revision of Inspection.  
Standard tests.  
6 seconds.  
7 seconds.  
Bombing, physical drill, bayonet work, etc., in S. B. R's.
11. *Lecture.*  
Duties of Company Gas N. C. O. in trench.  
First Aid. 45 min.  
Protected dugouts.  
*Practical.*—Revision of drill. 15 min.
12. *Practical.*—Clearing trenches and dugouts.  
Use of fans and fires.
13. *Visit to chlorine chamber at gas school for:*
  - a. Examination in standard tests.
  - b. Passing through chlorine.
14. *Gas cloud and gas shell demonstration at gas school.*  
Instruction for carrying into effect items Nos. 3, 13 and 14, will be announced later.

In the meantime other officers and sergeants were given from week to week a six-day course in gas defence by the Division Gas Officer, as prescribed by War Department Document No. 686, "Programme of Training in Gas Defence for Divisional Anti-Gas Schools."

## Part 10

### MISCELLANEOUS INSTRUCTION

**Map-reading.**—Truckmasters and assistant truckmasters at least, and it would be well that all chauffeurs, should be able to read military maps, using Chapter IX, "Manual for Non-Commissioned Officers and Privates," as a basis of instruction. The men should also be taught how to locate the points of the compass by natural and artificial means.

**Messages.**—Men of the grade of corporal and above should know how to write a field message, and every man in the company should know how to transmit messages. The following may be used as a basis for this instruction: "Manual

for Non-Commissioned Officers and Privates," Chapter XI; Moss, "Manual of Military Training," Paragraph's 1530, 979, 980, 981; War Department Document No. 631, "Musketry," Chapter X.

**Individual Cooking.**—"Field Service Pocket Book," Paragraphs 511-519 comprehensively covers this subject. Have the clerk typewrite a few copies of this chapter for the men to study by sections, and take the company outdoors on two or three different days to cook their noon meal over squad fires, following out the recipes given.

**French.**—If the company commander is familiar with French, or some member of the company, a period of instruction in French words and phrases, one hour per day, would be of help to the men for their early days on French soil. It is not believed that an intricate study of French grammar would be of any great value.

A bad weather schedule should be outlined so that in case out-door work cannot be carried on the company commander will not have to decide on some hit-or-miss way to keep the men occupied.

### Part 11

## TECHNICAL INSTRUCTION ON GAS ENGINES AND MOTOR VEHICLES

Both theoretical and practical instruction should be given. A comprehensive course in the former should be inaugurated when the company commander has been able to pick out his man who is the best combination of expert mechanic and instructor. If a motor can be obtained from which to illustrate this work, so much the better. Charts at least can be obtained from nearby automobile agencies. From time to time written tests should be given, which will be both a means of determining the degree of the men's attention to the work, and securing their attention.

If officers have been assigned to the Supply Train for their executive rather than their mechanical ability, it is desirable to get an expert to give them a course of technical lectures also.

Every effort should be made to have the men get practical work on motor vehicles: if their experience has been small, it will give them needed experience; if they have had a great deal it will enable the company commander who watches them to determine their relative proficiency. The establishment of a repair shop for work on other vehicles in the cantonment gives an opportunity to carry out, as different men can be detailed at it for a week or so at a time, till all have had the opportunity.

### Part 12

## SPECIAL INSTRUCTION FOR NON-COMMISSIONED OFFICERS

No time should be lost in getting to know the men of the company; it is desirable to pick the right truckmasters and also

desirable to get them as early as possible, and get the organization going as a motor truck company, whether the company has its trucks or is dismounted. In a very few days squad leaders can be picked, and nine times out of ten, it is safe to say that the capacity a man shows for running a squad indicates that he can be trusted with at least a permanent corporality, a corporal being a chauffeur. As soon as acting sergeants are selected it should be looked after that they are given instructions to fit their tasks, particularly the first sergeant (truckmaster), company clerk, and mess sergeant. An hour a day should be devoted to non-commissioned officers' conferences, at first the matters to be taken up would include largely special training for their parts in early drills. As time goes on, these conferences should bear more particularly on Supply Train work; they should be posted thoroughly in the organization and operation of the Supply Train, and the material in this book may be used as a basis for this instruction.

They should know to what equipment the company is entitled (chapter V), and should be acquainted with all the blank forms which a company uses, so that none may be at a loss at any time in filling them out. The men to attend these conferences should include not only acting sergeants but others who are capable of taking their places at any time.

### Part 13

#### A SAMPLE WEEKLY SCHEDULE

|        | A.M.                                     |      |      |       |       |       | P.M.                  |      |      |      |      |      |
|--------|--|------|------|-------|-------|-------|-----------------------|------|------|------|------|------|
|        | 7.30                                     | 8.45 | 9.15 | 9.45  | 10.15 | 10.45 | 12.00                 | 1.00 | 2.00 | 3.00 | 4.00 | 7.00 |
| HOURS  | to                                       | to   | to   | to    | to    | to    | to                    | to   | to   | to   | to   | to   |
|        | 8.25                                     | 9.15 | 9.45 | 10.15 | 10.45 | 11.45 | 1.00                  | 2.00 | 3.00 | 4.00 | 4.30 | 8.00 |
| Mon.   | A  | B    | C    | D&I   | E     | F     | G                     | H    | L    | I    | M    | N    |
| Tues.  | A  | B    | C    | D&I   | E     | F     | G                     | J    | L    | K    | M    | N    |
| Wed.   | A  | B    | C    | D&I   | E     | F     | G                     | H    | L    | I    | M    | N    |
| Thurs. | A  | B    | C    | D&I   | E     | F     | G                     | J    | L    | K    | M    | N    |
| Fri.   | A  | B    | C    | D&I   | E     | F     | G                     | H    | L    | I    | M    | N    |
| Sat.   | Competitive Drill & Inspection 8.30 a.m. |      |      |       |       |       | Fire Drill 10.00 a.m. |      |      |      |      |      |

A. Close Order Drill and Manual of Arms.

B. Physical Drill.

C. Saluting and Military Courtesies, Description of American Flag, Insignia Tests.

D. Extended Order Drill.

E. Preliminary Training for Target Practice, Care, Description and Cleaning of Rifle.

F. Close Order Drill.

G. Individual Cooking (at discretion of company commanders).

H. First Aid Instruction.

I. Instruction in Packs and Ordnance Equipment.

J. Signalling; Wigwag, Semaphore, Arm and Whistle Signals, including Truck Signals.

K. Army Regulation and Organization of a Motor Truck Company. (Lecture series.)

L. Theoretical Instruction in Gas Engines.

M. Study.

N. School for Truckmasters and Assistant Truckmasters. Non-commissioned Officers' School. Infantry Drill Regulations, Map Reading, Transmission of Messages, Writing Field Messages, Locating Points of Compass.

### NOTES

1. Lieut. Taylor will instruct Guard Company daily in Guard Duty, Ceremonies and Courtesies.

2. Lieut. Thorpe will have a company morning and afternoon, as per his schedule for Gas Instruction.

3. Mess Sergeants and Cooks' School 2 to 3 p. m. daily in Company B barracks.

4. The Guard company will furnish all details aside from those to Lieut. Moody.

5. Bad Weather Schedule as outlined.

6. Organization and Supervision of special work by officers as per schedule.

7. Companies will report to Lieut. Moody for day of Practical work on Motors at 7.30 a. m. as follows:

#### OLD SHOP

|            |         |     |
|------------|---------|-----|
| Monday,    | Company | (E) |
| Tuesday,   | Company | (B) |
| Wednesday, | Company | (A) |
| Thursday,  | Company | (D) |
| Friday,    | Company | (C) |
| Saturday,  | Company | (F) |

#### NEW SHOP

|            |         |     |
|------------|---------|-----|
| Monday,    | Company | (F) |
| Tuesday,   | Company | (A) |
| Wednesday, | Company | (B) |
| Thursday,  | Company | (C) |
| Friday,    | Company | (D) |
| Saturday,  | Company | (E) |



8. Companies will report for Lecture on Gas Engines at Company (A) barracks from 2 to 3 p. m., as follows:

|            |                       |
|------------|-----------------------|
| Monday,    | Companies (A) and (B) |
| Wednesday, | Companies (C) and (D) |
| Friday,    | Companies (E) and (F) |

9. Lecture on Gas Engines for Officers only at Company (A) barracks from 2 to 3 p. m., Tuesday and Thursday.

## Part 14

### WAR DEPARTMENT PLANS FOR SPECIAL INSTRUCTION OF SUPPLY TRAIN PERSONNEL

At the beginning the programme for instruction of Supply Train Personnel was as is indicated by the following extract from indorsement of A. G. O., Par. 3, dated August 24, 1917, on letter of Q.M.C., dated June 8, 1917:

"That for the present, motor vehicles, wagons, and animals, less those to be purchased in France by General Pershing, be shipped abroad in such quantities as will permit each division to be equipped with its trains upon arrival in France; but that as soon as the state of supply of motor vehicles will permit such action to be taken, the Quartermaster General arrange for the establishment of a camp at which instruction can be given to the personnel of a division designated for service abroad, for about one month prior to its embarkation. It should be noted in this connection that it is contemplated that the initial organization of the personnel of division trains will be effected in their respective divisional cantonments or camps, and their training carried forward in the full extent permitted by the facilities available in such cantonments or camps."

### USE IN MOTOR CONVOY SERVICE

With the first units of the expeditionary forces in France well equipped with motor trucks, and the supply more ample, it has become possible to adopt a more thorough plan of instruction for Divisional Supply Trains. This plan is contained in the following paragraphs of letter from the Quartermaster General to the Adjutant General of the Army, dated Jan. 29, 1918, said letter being indorsed by the Adjutant General to all Division Commanders:

2. In order to provide proper instruction and training for personnel of motor transportation units designated for service abroad, it is intended to use these units in Motor Convoy Service, Q. M. Corps, driving trucks overland from factories to Motor Storage Depots, Baltimore, Md., or other designated points. A list has been prepared based on information fur-

nished by Division Commanders, showing the status of each division supply train in regard to organization and equipment. Orders will be requested at the proper time for division supply trains to proceed to designated factories to receive instruction and have vehicle equipment turned over for the trip overland from factory to Baltimore. It is proposed to have each train make two trips from factories to seacoast. Orders will also be requested at the proper time, directing supply train commissioned personnel to report to Officer in Charge, Motor Convoy Service, for the purpose of making one instruction trip from factory to seacoast before making the two trips.

3. When the building now under construction at Baltimore for Mechanical Repair Shop Unit No. 306 is available, it will be recommended that a Division Supply Train be brought to that point for a short course of instruction with view to familiarizing the personnel with the gear shifts, brakes, etc., then sent to factory producing the trucks and drive the trucks to the Baltimore depot. It will also be recommended that this course of instruction be taken up for a month or six weeks prior to proposed sailing date of division; that the personnel make two cross country trips, then proceed from Baltimore to a port of embarkation to await transportation overseas.

4. Enclosed are copies of instructions to organizations on Motor Convoy Service.

5. As will be seen, this driving trucks overland in winter weather from Chicago, Detroit and other manufacturing centers to the seacoast will afford ample opportunity for instructing personnel under conditions more severe than will be found in France, in so far as road conditions are concerned.

GEO. W. GOETHALS,

Acting Quartermaster General.

The commander of a Supply Train motor truck company which is about to be sent on the trip indicated in the above plan, receives the following letter of instructions: (Special instructions for assistant truckmasters and chauffeurs as printed below are also given him.)

#### MOTOR CONVOY SERVICE, QUARTERMASTER CORPS

From: Officer in Charge, Motor Convoy Service.

To: Commanding Officer, Truck Co. No. .... Div. Supply  
Train No. ....

Subject: Instructions for Trip.

1. The equipment of one truck company will be delivered to you by this office for delivery to the Quartermaster, Motor Storage Depot, Baltimore, Md. The route you are to follow is laid down in the route slip herewith. Sleeping accommodations are available in the towns indicated as night stops, as shown.

- 2. The following instructions are additional to those given to truckmasters and chauffeurs, a sufficient number of which are supplied herewith.

3. Careful study is recommended of the truck manual, which is a compilation of truck company technique gained through a great deal of hard experience. Company commanders will see that their men study the instructions herewith and the truck instruction book and will quiz them in regard to their knowledge.

4. Before leaving . . . . ., each company commander will be required to receipt for the trucks, equipment and cargo on Waybill Form 248, and Record of Property Transported Form 249. These books will be carried with the company and delivered to consignee. Mimeographed forms will be supplied to him so that each chauffeur can sign a receipt for his own truck, tools and equipment. Each chauffeur will also sign a memorandum receipt in triplicate for the cargo on his truck. One copy of each receipt will be retained by the company commander and one by the chauffeur. Triplicate copy of the receipt for cargo will be sent to Quartermaster, Motor Storage Depot, Baltimore, by mail. If chauffeurs are changed it is recommended that the property be checked and the new chauffeur be required to sign receipts. On arrival at Baltimore, all property will be turned over to Quartermaster, Motor Storage Depot, who will receipt Waybill Form 248. Any shortages will be noted on the back of the form and disposed of by survey. The company commander is responsible for the safe delivery of all trucks, equipment and cargo, and unless the above system is thoroughly carried out, is very likely to pay for shortages. The individual responsibility of chauffeurs should be emphasized.

5. Trucks should always be filled with gasoline and oil at night, so as to be ready for an early start. The train should never start later than 7 a. m.

6. As explained in the instructions to chauffeurs, it has been found best to run sections independently. No harm is done if they are several miles apart. It is the duty of the company commander and the truckmaster to keep in touch with all sections, and to see that they do not get too far apart. In general, the place for the company commander is at the rear of his train, where he can go forward at once in case of stoppage, but at the end of the day's run he should be at the stopping place to see that the trucks are parked properly, etc.

7. It is recommended that the cook truck be attached to the first section so as to get an early start on supper. If tank trucks are supplied, it is recommended that one run about in the middle of the train, and one last. If there is only one gasoline truck, it should go last. The truck with spare parts, etc., should go next to last. If snow is encountered, it is recommended that ten or more men with shovels be carried in the first truck. It is much easier to dig through a drift before a



truck gets stuck in it than afterwards, and a truck cannot buck its way through deep snow.

8. On narrow roads it is practically impossible for anyone to pass the train. Have a responsible man (the company clerk is suggested) on the first truck to warn people that thirty trucks are coming, and in difficult places to suggest that they pull out and let the trucks go by.

9. Particular attention should be given to chains. During the winter it will be necessary to use them practically continuously. It must be remembered that chains have a bad effect on the truck in two ways: the bump on the rear end of the truck when each chain hits the road, and on icy surfaces the jerk to the rear axle as the wheel slips during the period when no chain is under the wheel. When running on dry roads with only occasional slippery patches, the use of four chains only is recommended, but where there is snow or ice continuously, a full set of seven should be insisted on. In any case, the same number of chains should be used on each rear wheel, to avoid undue wear on the differential, and broken chains should be immediately removed and replaced.

10. Too much emphasis cannot be laid on the importance of impressing the assistant truckmasters with their entire responsibility for their sections. It is on them that the efficiency of the company most stands or falls. Mechanics should be appointed in every company. Even if they are not especially skillful, they can relieve the assistant truckmasters of watching lubrication, and keeping the sparks advanced and (on the Packard) keeping the air adjustment levers open. The almost universal habit of chauffeurs is to use too rich a mixture. It is recommended that a mechanic be assigned to each section.

11. In case of serious trouble with a truck inform this office by wire immediately, stating what new parts are necessary. When practicable, tow the truck to the nearest town; if impracticable, leave it in the road. In any case leave the chauffeur with the truck, impressing upon him the fact that he is still responsible for the tools and equipment, and instruct him, when repairs are completed, to report to the commanding officer of the first truck company coming through, but not to proceed alone, unless it is possible for him to catch up with his own company within two days. This office will procure spare parts and if necessary mechanics from the nearest service station, or if necessary, send them from . . . . . with the next company leaving.

12. Each company commander will report by telegraph each night to the Quartermaster General and to this office the time of arrival, road conditions encountered, and any other information thought to be valuable. At each regular stopping place, inquiry should be made for telegrams. In case of delay, it will be necessary to hold up the companies following, to prevent con-



gestion. Every attempt will, therefore, be made to get off a telegram to this office as early as possible. If the report is at all late the company commander should get in touch by telephone with the company directly behind him. Every company commander has a separate detachment in the field, and must use his own judgment in emergencies, but no effort should be spared to put his company through on the regular schedule.

13. Accurate records of cost of trip will be kept as prescribed in the Truck Manual, keeping Drivers' Daily Truck Reports (Model B, Manual) and Cost Record (Model C, Manual). This must be kept on passenger cars and ambulances, if furnished, as well as on trucks. It must be kept up daily. At end of trip, make out forms 416 and 417 Q.M.C., giving cost of operation of each vehicle, in triplicate, and send to this office.

14. By authority of the Quartermaster General, this office is authorized to purchase for companies in Convoy Service, heated sleeping quarters, when necessary, and the authorized allowances of fresh beef, bread, ice and potatoes, or the authorized substitutes. For each purchase, a bill will be secured, a voucher (From 330 W.D.) will be prepared and signed by the seller, but not certified to. The company commander will place his initials opposite the space for certification, and mail the voucher to this office. The bill will be delivered to the train supply officer at Baltimore.

15. If tanks are supplied the company has an ample supply of gasoline for two days. If they are not supplied one truck will be loaded with gasoline in drums. This is to be used only in emergencies. The 30-gall tank on each truck should be sufficient for one day's run. Sufficient oil and gasoline for all cars has been arranged for in each town designated as a night's stop. In Ohio with the Standard Oil Co., and in Pennsylvania with the Atlantic Refining Co. In emergencies gasoline may be purchased anywhere, but in the smaller towns only a very limited supply is available.

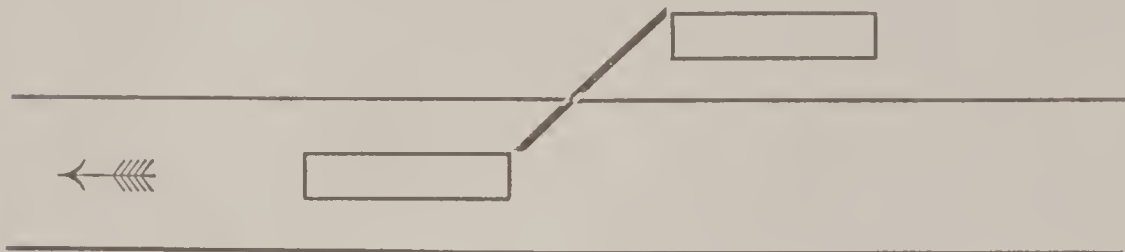
## INSTRUCTIONS FOR TRUCKMASTERS AND ASSIST- ANT TRUCKMASTERS IN CONVOY SERVICE

1. Read carefully the instructions to chauffeurs. Remember that you are absolutely responsible for your section, its proper maintenance and operation. See personally that all of your trucks are filled with gasoline, oil, and water or anti-freeze solution. Always see to it that your section keeps together.

2. Always try to instruct your men in driving. Most delays on the road are the result of bad driving. Try not to have your section the one that is holding up the train. This is up to YOU.

3. If a truck runs off the road, don't let the driver spin his

wheels and dig himself in. If not badly stuck a number of men can often push the truck out. If they cannot, back up the truck ahead or bring up the next truck behind and pull him out. Fasten the tow cable like this:



If a truck cannot pull him out perhaps two can, but it is difficult to get all three trucks pulling at once, as it is almost impossible with more than two.

4. If it is badly stuck or far down a bank get a block and tackle, which will ordinarily be carried in the Dodge truck. If a tree or telegraph pole is not available as a "dead man," a truck with wheels blocked, or several fastened together with tow cables, can be used.

### INSTRUCTIONS FOR CHAUFFEURS IN CONVOY SERVICE

1. A truck, equipment and cargo is turned over to you, and you are to sign a receipt for it. Lost tools and equipment will be charged to you. Your assistant is under your direction and is to help you, but your responsibility cannot be passed over to him.

2. Before starting to drive study carefully the instruction book. Read especially the rules for lubrication. On the Packard the oil in the crankcase is sufficient when it runs out of the overflow cock with the truck on the level. The crankcase is not full unless it runs over. Be sure the cock is closed after filling. All oil cups (see page 10, instruction book) must be filled daily.

3. Remember that driving a truck is a very different matter from driving a touring car. A touring car at speed will practically keep itself in the road, a truck never will, and it is necessary to drive all the time. Constant watchfulness is essential.

4. Keep your spark advanced. The air control lever on the Packard is different from other makes of trucks and car. It should be kept as far open (to the left) as possible. A too rich mixture does NOT give more power. If you get in trouble call the assistant truckmaster or mechanic. NEVER touch the magneto, carbureter, or governor.

5. In going up a hill decide at the bottom what gear will be necessary and change there. Never go as far as you can in high and try to change on the hill. You can't do it with a truck.

6. In going down hill don't trust entirely to the brakes. You

can easily burn them out, especially the foot brake. On long down grades shift into third (not second or first) and use the hand brake.

7. If you start to skid DON'T LOCK THE WHEELS. You may be on bare rubber, with no chain under you. Allow the wheels to turn slowly, using the brake gently. Always start and stop gradually.

8. All trucks of a section must keep together. Never get nearer than 50 yards to the truck AHEAD of you, nor more than 150 yards ahead of the truck BEHIND you. Someone on your truck must keep looking back. This is what your assistant is for. Each section runs independently, the last truck of a section not waiting for the truck behind it unless contrary orders are given by the company commander or truck-master.

9. While every courtesy should be shown to other travelers on the road, remember that if a truck gets off the crown of the road with the right wheels on ice or in mud it is stuck. A touring car can get off much further than you can without getting into trouble. Keep on the hard road and let the other fellow get off.

## Part 15

### PROBLEMS FOR OFFICERS

The solution of Military problems by officers is a desirable preparedness feature of Supply Train work. These can apply profitably to any number of different situations. The majority of officers will not have previously had the experience of transporting troops and might easily go up to the last day before receiving orders to move without a clear idea of what they were going to do when they did receive their orders. In this Train the following problem was submitted to the Company Commanders by the Commanding Officer for solution:

Headquarters 301st Supply Train.

Camp Devens, Ayer, Mass.

January 19, 1918.

### GENERAL ORDERS

#### No. 1

1. The 301st Supply Train will proceed by rail on the 25th of January, 1918, to Hoboken, N. J.

2. Full equipment, all motor transportation, two cooked meals, and three field rations will be taken. All allowances of baggage will be in accordance with War Department instructions for overseas services as shown on sheet attached.

3. The schedule of departure will be as follows:

Cars and coaches will be marked for companies which are to have them. All sections will be spotted on Tracks 3 and 4, rear of Q.M. Storehouse. Eight men will be detailed by each of Companies A, B, C, D, E, and F to report to Lieut. W. D. June as train guards, and they will be assigned by him to their respective sections.

Section Officers will see that Q. M. C. Form 471 attached is strictly complied with.

| <i>Section</i> | <i>Under Command of</i> | <i>Cars</i>                             | <i>Where Spotted</i>                | <i>When Spotted</i>                           | <i>When Leaving</i>         |
|----------------|-------------------------|---|-------------------------------------|---|-----------------------------|
| 1.             | Lt. A. H. Anderson      | 20 Flat                                 | Rear Storehouse<br>Track No. 3      | Not later<br>than 4 p.m.<br>Jan. 22,<br>1918  | 8 a.m.<br>Jan. 23,<br>1918  |
| 2.             | Lt. J. B. Moody, Jr.    | 20 Flat                                 | Rear Storehouse<br>Track No. 4      | Not later<br>than 4 p.m.<br>Jan. 22,<br>1918  | 10 a.m.<br>Jan. 23,<br>1918 |
| 3.             | Lt. S. B. Butler        | 20 Flat                                 | Rear Storehouse<br>Track No. 3      | Not later<br>than 6 a.m.<br>Jan. 23,<br>1918  | 12 Noon<br>Jan. 23,<br>1918 |
| 4.             | Lt. J. L. Fox           | 19 Flat                                 | Rear Storehouse<br>Track No. 4      | Not later<br>than 6 a.m.<br>Jan. 23,<br>1918  | 2 p.m.<br>Jan. 23,<br>1918  |
| 5.             | Lt. R. J. Travers       | 19 Flat                                 | Rear Storehouse<br>1st. Clear Track | Not later<br>than 10 a.m.<br>Jan. 23,<br>1918 | 4 p.m.<br>Jan. 23,<br>1918  |
| 6.             | Lt. W. D. June          | 11 Day<br>Coaches<br>1 Box<br>1 Baggage | Rear Storehouse<br>Track No. 3      | Not later<br>than 12 m.<br>Jan. 25,<br>1918   | 3 p.m.<br>Jan. 25,<br>1918  |

Lieut. A. H. Anderson will have charge of the unloading at Hoboken.

Company commanders will submit to the Supply Train Commander not later than 10:00 a. m., January 22, 1918, detailed plan for the carrying out of this order.

Note return required by A.R. 812.

OLIVER SCHOONMAKER

Major Inf., R.C.

Commanding 301st Supply Train.

Refer to Part 4, Chap. VII, for information to assist in troop movement problem.



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